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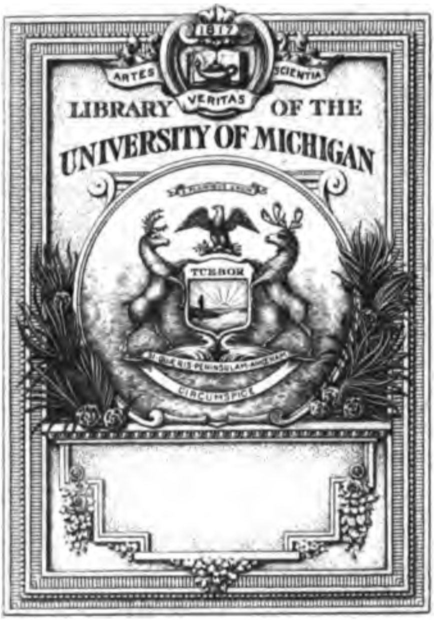

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REPORT

OF THE

SECRETARY OF THE NAVY;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE SECOND SESSION OF THE FORTY-FIFTH CONGRESS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1877.

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REPORT

OF

THE SECRETARY OF THE NAVY.

WASHINGTON CITY, D. C.,
Navy Department, *November* 30, 1877.

SIR: I have the honor to submit the regular annual report of the condition and operations of the Navy Department.

The Navy consists of 67 steam and 23 sailing vessels, 23 iron-clads, 2 torpedo, 1 ferry, and 26 tug boats. The tonnage and displacement of each vessel will appear in an accompanying table, and the following statement is deemed necessary to a full understanding by Congress of the present condition of the Navy.

The foreign and ocean service is performed by six squadrons, composed as follows:

EUROPEAN SQUADRON, under command of Rear-Admiral William E. Le Roy: Trenton, flag-ship; Vandalia, Marion, Alliance, Gettysburg, and Despatch, the latter being assigned to special service in connection with the United States embassy at Constantinople.

ASIATIC SQUADRON, under command of Rear-Admiral Thomas H. Patterson: Tennessee, flag-ship, Kearsarge, Ashuelot, Monocacy, Alert, Ranger, and Palos. The Tennessee has been ordered home, her cruise having expired, and will probably return through the Suez Canal. She will be superseded by the Monongahela.

NORTH ATLANTIC SQUADRON, under command of Rear-Admiral Stephen D. Trenchard: Powhatan, flag-ship, Plymouth, Ossipee, Swatara, Enterprise, and Huron.

The Huron was wrecked on November 24, 1877, on the coast of North Carolina, at a point near Nags Head. She sailed from New York under instructions to make a scientific reconnaissance of the coast of Cuba, and arrived at Hampton Roads on the 17th November. On the morning of the 23d she left Hampton Roads, and shortly after 1 o'clock a. m. of the next day struck upon the beach and was wrecked. She encountered a moderate gale and a heavy sea from the eastward, but being in good condition, well manned, and with her engines and machinery in perfect order, it is believed she could have encountered the storm without harm if she had remained out in the open sea. She had one hundred and thirty-two officers and men on board, thirty-four of whom were saved, and the remaining ninety-eight lost, including the commander. I have organized a court of inquiry to investigate all the facts connected with this unfortunate event, and will make it the subject of a special communication to Congress when the result is ascertained.

SOUTH ATLANTIC SQUADRON, under command of Commodore E. T. Nichols: Hartford, flag-ship, and Essex.

NORTH PACIFIC SQUADRON, under command of Rear-Admiral Alexander Murray: Pensacola, flag-ship, and Lackawanna. To prevent an anticipated outbreak of the Indians, the Lackawanna was recently sent to Puget's Sound, and, after having assured a peaceful adjustment of all impending difficulty, has returned to San Francisco.

SOUTH PACIFIC SQUADRON, under command of Rear-Admiral George H. Preble: Omaha, Onward, and Adams.

The following are employed as receiving-ships:

Colorado and Vermont, at New York; Franklin, at Norfolk; Wabash, at Boston; Wyoming and Relief, at Washington; Independence, at Mare Island; and St. Louis, at League Island.

The following as training-ships:

Minnesota, at New York; Constitution, at Philadelphia; Saratoga, at Norfolk; Dale, as instruction-ship at Annapolis; St. Mary's, as marine-school ship at New York, and Jamestown as marine-school ship at San Francisco.

The following are in ordinary:

Niagara, at Boston; Susquehanna, Shenandoah, and Supply, at New York; Congress, Kansas, and Sabine, at Kittery; Narragansett, Saco, Nyack, and Cyane, at Mare Island; Shawmut and Savannah, at Norfolk; Yantic and Frolic, at Washington. The Savannah is fitted for an ordnance store-ship.

The following are laid up:

Florida, at New London; Iowa, at Boston; Lancaster, at Kittery; Brooklyn, at New York; Worcester and Juniata, at Norfolk; Iroquois, at Mare Island; and Constellation, used as practice-ship, at Annapolis.

The following are on the stocks:

Connecticut and Pennsylvania, at Boston; Java and New York, at New York; and New Orleans, at Sackett's Harbor.

The following are undergoing repairs:

Richmond and Wachusett, at Boston; Alaska, at New York; Benicia and Tuscarora, at Mare Island; Ticonderoga, at Kittery; and Canandaigua, at Norfolk.

It is estimated that the cost of these repairs will be about as follows: Richmond, $126,000; Alaska, $100,000; Benicia, $70,000; Ticonderoga, $90,000; Canandaigua, $60,000; Wachusett, $50,000; and Tuscarora, $28,000, making an aggregate of $524,000. These vessels will be ready for sea, it is believed, during the present fiscal year.

The following are in progress of construction: Quinnebaug, at League Island; Galena, at Norfolk; Mohican, at Mare Island; and Nipsic, at Washington.

The Quinnebaug will be soon ready for sea. The Galena and Nipsic are progressing as rapidly as possible. Work on the Mohican has been suspended to await the action of Congress.

The following are so much decayed as to be unfit for repairs or completion: Connecticut, Iowa, and Pennsylvania, at Boston; Java and Susquehanna, at New York; Congress, Kansas, and Sabine, at Kittery; Worcester and Shawmut, at Norfolk; Saco, Nyack, and Cyane, at Mare Island; Frolic, at Washington; and New Orleans, at Sacket's Harbor.

The Michigan is in commission on Lake Erie, in readiness to render such assistance as the commerce of the lakes may require. The Tallapoosa is used as a dispatch vessel between Washington, Norfolk, League Island, New York, Newport, New London, Boston, and Kittery. The Rio Bravo was sent up the Rio Grande River more than a year ago, and remains there, anchored at Brownsville, from which place she cannot now proceed either up or down stream in consequence of the shallowness of the water. She can, therefore, only render such assistance to that exposed frontier as could be afforded by a local fortification with the same number of men and guns, or by transferring the men for military service on shore in case of necessity. The New Hampshire is now lying at Port Royal. The Santee is used as a gunnery ship at Annapolis; the Jamestown as a marine school-ship at San Francisco, under act of Congress June 20, 1874; the Pawnee for storing coal at Port Royal; the Guard for astronomical service in the Atlantic; and the Onward as a store-ship at Callao.

The following twelve iron-clad vessels are in commission and partial commission:

Ajax, Catskill, and Lehigh, at Sandy Point, James River; Canonicus, at New Orleans; Montauk, Passaic, Saugus, and Wyandotte, at Washington; Nahant, at League Island; Manhattan and Mahopac, at Norfolk; and Nantucket, at Annapolis. These vessels have to be kept in fresh water when not in actual service, in consequence of the injury they receive from barnacles and oysters when exposed for any length of time to the salt water of the ocean. They are unfit for sea-service, and are only useful for harbor and coast defense. In case of an attack by an enemy upon any of the commercial cities lying on our coasts, they would be of incalculable value for this purpose. They have no power to move against head seas, inasmuch as, being only about twelve inches out of water, every sea breaks over them. It is not deemed best to keep them all in commission for sea-service, but merely in such condition, and at such convenient places in fresh water, as will hold them in readiness for active employment at any time when needed.

The following are in ordinary:

Camanche, at Mare Island; Dictator and Jason, at League Island.

The following are in progress of construction:

Amphitrite, at Wilmington, Delaware; Miantonomoh and Puritan, at Chester, Pennsylvania; Monadnock, at Vallejo, California; and Terror, at Philadelphia. The work on the Amphitrite, Puritan, and Terror has been suspended in consequence of contracts therefor having been made when there was no money in the Treasury which could be expended for that purpose.

The Colossus is on the stocks at New York, but having been built of white-oak timber, is so decayed as not to be worth completing. The Massachusetts is in the same condition at Kittery; and the Oregon also at Boston. The Roanoke was transferred in part payment for work on the Puritan, by contract of March 3, 1877, which was suspended for reasons herein stated. The Severn was also transferred for work on the Puritan, by arrangement previous thereto.

The Manhattan is in dock at Norfolk, undergoing repairs, which, it is estimated, will cost about $3,000; and the Mahopac is at the same place, also needing and awaiting repairs.

Both of the torpedo-boats are in commission; Intrepid at New York, and Alarm, recently at Newport, but now under orders for Washin ton.

The following tug-boats are in ordinary:

Cohassett, at Boston; Pilgrim, at League Island; Rescue, at Washington; Sorrel, at League Island; and Speedwell, at Kittery. The latter has recently returned from a voyage to Halifax, under charge of Prof. S. F. Baird, United States Fish Commissioner.

The following are laid up:

Standish, at Norfolk; Spuyten Duyvil, at New York; and Blue Light, at New London.

The Catalpa is in running order at New York; Emerald at Kittery; Fortune at Norfolk; Glance at League Island; Jean Sands at Norfolk; Leyden undergoing repairs at Boston, at an estimated cost of $10,000; Mayflower and Wyandank at Annapolis; Monterey at Mare Island; Nina performing torpedo duty at Newport; Phlox in use at Naval Academy; Pinta attached to North Atlantic squadron; Rescue at Washington; Rocket undergoing repairs at New York, at an estimated cost of $500; Rose at Pensacola; Snowdrop at Norfolk; Triana undergoing repairs at Washington, at an estimated cost of $6,000; Grapeshot at New York, and Seaweed at Port Royal. The Blue Light and Sorrel are completely worthless and unfit for repair.

PERSONNEL.

The active list of the Navy is composed of 1 Admiral, 1 Vice-Admiral, 11 rear-admirals, one of whom, Rear-Admiral John Rodgers, is retained on the list, in addition to the 10 allowed by law, by reason of having received the thanks of Congress for gallantry; 25 commodores, 50 captains, 90 commanders, 80 lieutenant-commanders, 280 lieutenants, 100 masters, 71 ensigns, 77 midshipmen, 43 cadet-midshipmen, and 213 cadet-midshipmen on probation at the Naval Academy, all of whom are officers of the line.

Of the staff, there are 1 surgeon-general, 14 medical directors, 15 medical inspectors, 50 surgeons, 52 passed assistant surgeons, 44 assistant surgeons, 1 paymaster-general, 12 pay-directors, 13 pay-inspectors, 50 paymasters, 30 pasted assistant paymasters, 20 assistant paymasters; 1 engineer-in-chief, 69 chief engineers, 97 passed assistant engineers, 43 assistant engineers, 19 cadet-engineers, and 63 cadet-engineers on probation at the Naval Academy; 24 chaplains, 12 professors of mathematics, 1 secretary for the Admiral, and 1 for the Vice-Admiral; 1 chief constructor, 10 naval constructors, 5 assistant constructors, and 9 civil engineers.

The warrant-officers consist of 54 boatswains, 59 gunners, 50 carpenters, and 41 sailmakers. There are also 45 mates in the service.

There were in the service on the 24th day of November, 1877, 7,012 enlisted men and boys.

The retired list is composed of 41 rear-admirals, 26 commodores, 15 captains, 13 commanders, 14 lieutenant-commanders, 6 lieutenants, 13 masters, 5 ensigns, 2 midshipmen, 3 surgeons-general, 18 medical directors, 1 medical inspector, 2 surgeons, 2 passed assistant surgeons, 5 assistant surgeons, 3 paymasters-general, 5 pay-directors, 3 paymasters, 2 passed assistant paymasters, 2 assistant paymasters, 5 chief engineers, 17 passed assistant engineers, 23 assistant engineers, 1 chief constructor, 4 naval constructors, 7 chaplains, 4 professors of mathematics, 9 boatswains, 5 gunners, 11 carpenters, and 12 sailmakers.

The active-list is therefore composed of 829 officers of the line, 594 officers of the staff, and 249 warrant-officers.

The retired-list is composed of 135 officers of the line, 103 officers of the staff, 27 warrant-officers, and 4 professors of mathematics.

This statement of the condition and strength of the Navy is deemed necessary to enable Congress to adjust appropriations to the necessities of the service and the condition of the Treasury.

An effective navy is a positive necessity; but the main difficulty lies in deciding upon the point of efficiency to which it is expedient and proper to carry it. The leading nations of Europe have such close political relations that the fear of disturbing the existing balance of power is constantly communicating itself from one to the other, and thereby each is influenced to keep itself in readiness for any military or naval exigency that may arise. Hence the necessity for large standing armies and extensive navies. But what they may do or not do, as it regards their intercourse with each other, whether in peace or war, does not directly concern us as a nation, and yet it has such indirect relation to the United States, as one of the great powers of the earth, that our own policy must in some degree be influenced by theirs.

Our situation—about midway between Europe and Asia—forbids any immediate or direct interference by the United States with the affairs of the nations possessing either of those continents. Nor is it reasonable to expect that, occupied as the European nations are, and are likely to be for many years to come, with questions which seem inseparable from their relations with each other, they will find it to their interests to adopt an aggressive policy toward the United States. We may safely adopt such a course, therefore, with reference to our Navy as is dictated by our own domestic interests alone, separated, as they are, except by commercial intercourse, from those of other nations.

Our constantly-increasing capacity to become one of the leading commercial nations, excites our national pride. Our agricultural productions—the basis of our prosperity—already exceed those of any other country, and are rapidly increasing. In many ways our condition is a controlling one, both as it regards our example and the necessities of other nations supplied by our industry. Not only have we given respectability to labor, but, in various ways, have increased its productiveness and value. In the mechanic arts we are unexcelled. Our mineral wealth is inexhaustible, and already is its vast importance recognized in the fact that we are supplying American iron to British workshops. The coal-fields of England are rapidly failing, on account of their immense depth, while ours are not only of incalculable extent, but near the surface. Everything, in fact, combines to show that we possess a rapidly-growing internal commerce, which only needs the fostering care of the government to secure to it an ultimate development which cannot be surpassed by that of any other nation. During the last year the value of this commerce transported on the various lines of railroads was estimated at $18,000,000,000, and during the present year, in consequence of the increased product and value of grain, it will greatly exceed that.

As our internal commerce increases beyond our own power of consumption, the excess must either find a foreign market or the loss falls upon the producer. All commercial nations understand this, and therefore their efforts to secure foreign markets for their exports. The greatness of Great Britain is in a considerable measure owing to the steadiness and consistency of her policy in this regard. There is no inlet in any sea where the vessels of her mercantile marine do not penetrate. Even at the present time, when our trade is slowly recovering from its paralysis and demanding additional means of supplying the wants of the thousands of meritorious artisans and workmen who are out of employment, her merchants and capitalists are actively engaged in making our foreign commerce tributary to their own by forcing us into dependence upon British vessels for the transportation of our surplus productions. They snatch the trade of a considerable portion of the American continent from our hands. Brazil exports to England annually over $112,000,000 of her products, for which she receives in exchange nearly the same amount of imports. This trade is carried on by direct lines of communication and, in a great measure by steamships to which large government subsidies are paid; while for the want of lines of steam communication between our Eastern cities and Rio, our most expeditious route to Brazil is by England. And that country has secured similar advantages to her merchants over ours, although not in the same degree, with regard to the trade all along the eastern and western course of South America, as well as that with China, Japan, and Australia. Of the exports from China, more than three times as much go to Great Britain as come to the United States, and with the imports the difference is still greater.

The policy of the Japanese Government, induced by influences adverse to our commercial interests, has secured to the English and French lines of steamers almost its entire trade, while an American line of steam-vessels from Yokohama to Shanghai has been compelled to withdraw. Australia exports about $240,000,000 a year, and imports nearly as much; and almost this entire trade is carried on with England and her dependencies.

The superiority which both England and France have obtained over us with reference to this vast trade may be attributed in a large degree to the fact that each of these governments pays annually to its steam-lines between $4,000,000 and $5,000,000 in subsidies, while the Government of the United States has contributed to the superiority England has thus acquired by also paying subsidies to her steam-lines out of its own revenues. The result has been to increase the foreign over our domestic tonnage so steadily, since the close of the war, that our interest in ocean mercantile navigation is annually decreasing. Before the war our foreign export and import trade was carried on 100 per cent. more in American than in foreign vessels. Since the war it has been carried on 100 per cent. more in foreign than in American vessels. Until this condition of things is changed, our commercial independence cannot be established upon such a basis as it deserves to be.

While our Navy is not engaged in commerce, it is its important and necessary ally. It should be, at all times, ready to furnish it protection in whatsoever sea it may be required. All the nations should understand that we are as ready to afford it this protection as we are to avenge an insult to our national flag. Without foreign commerce, we must sink into inferiority; and without a Navy amply sufficient for this purpose, all the profits of our surplus productions will be transferred from the coffers of our own to those of foreign capitalists. The rewards of our own industry and enterprise belong to ourselves, and we cannot fully maintain our independence without their enjoyment. The profits of the American agriculturalists are as much their property as the lands which produce them, and those of the laborer and artisan, in all the spheres of life, should be held in as sacred regard. The government cannot withhold its fostering care from either without detriment to itself.

Is our Navy in its present condition sufficient to furnish the necessary amount of protection to our commerce? If we consider our commerce at its present stage of development, or are content to leave it to be transported abroad in foreign ships, and thus deprive the American producer of the profits of his labor, it may be sufficient. But if we are to take the position among the commercial nations to which we are justly entitled; if we are to secure to our own people the right to transport the products of their industry into whatsoever part of the world they may be demanded, so that the profits may be returned to increase the aggregate of our national wealth, then, in my opinion, it is not in such condition. There may be ships enough in number if they were all in proper repair to increase our squadrons to a sufficient size for this purpose. To put them all in repair, however, would require a larger expenditure than is practicable in the present condition of the Treasury, and probably larger than would be justifiable at any time until our revenue from customs shall be sufficiently increased. As we may expect this from a gradual development of our commerce, so, as this occurs, we may gradually carry the Navy up to the point of necessary improvement; a point to be decided by the existing wants of trade.

It is manifestly a national duty to keep the Navy in such condition as to make it available in the future for all the purposes for which it may be designed. Considering it in this light, the estimates for the ensuing year have been made with reference only to ordinary expenditures, such as are absolutely necessary for repairs and limited construction. No new ships are estimated for, because that would involve an expenditure larger than the receipts into the Treasury will be likely to justify. Those now possessed and in progress will be sufficient for all ordinary purposes in time of peace, and if, from any emergency not anticipated, a larger number of vessels should be demanded, the experience of the late war has proved that we must rely upon our mercantile marine for a supply of the material of a Navy whenever it is demanded. This mercantile marine depends, for its effectiveness and extent, upon the protection given to commerce by the government, necessarily increasing with the increase of commerce. If we had steamship lines running directly from our own ports to all the leading commercial ports in the world, they would not only increase our revenue, but render it more easy to improvise a navy in the event of an unexpected emergency. These vessels are constructed for speed, and can be easily converted to purposes of naval warfare. They will increase in number and importance as our capacity to give naval protection to our commerce increases, and hence we find one ground for the necessity of keeping our Navy in a condition to furnish this protection.

The government, of course, contributes nothing directly toward building up our mercantile marine, as vessels for that purpose are necessarily built in private ship-yards. The enterprise of the owners of these is greatly to be commended, as some of the ships constructed at them are among the finest in the world. Those built at these yards for the government are supposed to be equal to any of their class, but it is not conceded that they are either superior to or more economically constructed than ships of the same class may be built at the government navy-yards. One reason why heretofore it has cost more to build a ship at the latter than at the former yards has arisen out of the fact that the government has paid the same wages for eight hours of labor per day that private ship-builders have paid for ten hours; the latter obtaining, therefore, one-fifth more labor per day than the former. With this inequality removed, it is believed that ships may be built as cheap at the government as at private yards, and yet, at the same time, an increasing commerce will require the utmost energies of both.

Our ships have been built without sufficient care as to the character of the timber of which they are composed. Some of them, only a few years old, already begin to show such signs of decay as to require frequent repair in consequence of the use of timber not properly seasoned. A live-oak ship will last several times as long as one built of white oak. We have now on hand some of these white oak ships so far decayed as to render it questionable whether it would not be bad economy to repair them. Authority is given by law to sell these when they shall have reached this condition; but the consequence of such sales is that the proceeds are covered into the Treasury and are inapplicable to other naval purposes without reappropriation by Congress. If this were otherwise, and the value of ships so defective as not to be fit for repair could be applied to the improvement of those that are, our present Navy, though the number of its vessels would be somewhat reduced, could be made in a few years to consist of ships equal to any in the world of the same class. This, however, cannot be done without a change in the existing law governing the sale of public property; and if this is done, it is considered important that it should be so changed as to prohibit the private sale of a vessel or other naval property under any circumstances for less than its appraised value. Ships and other property have, in some instances, been privately sold for less than this value, and, therefore, for less than the actual worth was ascertained to be; and this practice ought neither to be recognized nor tolerated by law. If private sales were prohibited and the appraisement and price received required to be reported to the Secretary of the Treasury and by him to Congress, a sufficient check could be placed upon the operations of the Navy Department to establish its responsibility for the sums received and for their proper disbursement. They could by this means be applied to the improvement of the remaining ships, and the Treasury, to that extent, be relieved.

But the relation the Navy sustains to our foreign commerce is not the only aspect in which it is necessary to consider it; for although it is true that we shall not attack any foreign power, and no foreign power is likely to attack us, either on land or sea, yet the nation is unwise which does not provide for possibilities in its future history. Howsoever peaceful a nation shall be, it should not altogether ignore the idea that some time or other it may be forced to engage in war.

The present condition of the Navy, relatively to other powers, has less aggressive force than at any time during the past third of a century, except during the war, or less power to inflict serious injury upon the commerce of an enemy. Indeed, the fact cannot be concealed, and ought not to be, for it is well known to other nations, that third and even fourth rate powers, almost without exception, are superior to us in this respect.

For some years past large sums have been expended in refitting a number of vessels of the class known as "monitors." Perhaps, under the particular conditions and our uncertain relations with another power, rebuilding them was not unwise, inasmuch as on our immediate coast, and within and adjacent to the Gulf of Mexico, they could be effectively employed in connection with other vessels, and for purposes it is not now pertinent to discuss. Apart from these monitors and a considerable amount of material for construction now on hand, we have but little to show, comparatively, for these large expenditures.

Three of the recently constructed vessels were of iron and uncased, a construction for many years discarded for cogent reasons. The other vessels recently constructed have, in general, fair models and ordinary speed, and will compare advantageously in rigidity, speed, and some other essential qualities, with those of the same class now constructed by the great naval powers. However little the government may desire to vie with the European nations in expensive naval construction, on account of its isolated position and the nature of our peaceful pursuits, it would seem that the Navy, whether regarded as the support of commerce or the means of national defense, should not be kept in its present condition of inferiority. The least that should be done is that already suggested, to put the ships we have in as perfect condition as they are susceptible of, and gradually hereafter, when the revenues shall be sufficient to justify it, build other ships, of such classes and styles of construction as our own and the experience of other nations shall warrant. Otherwise, great national interests may be endangered and humiliation brought upon us, even by inferior powers, in the event that any of them should be disposed to take advantage of our unprepared condition.

This department has not ventured to propose an expensive, and what would, in all probability, prove an ineffective attempt to copy after, or to design and build, these costly vessels, which in commission are enormously expensive, and, whether in service or laid up, undergo rapid deterioration. It nas supposed that its duty would be discharged if it were permitted, as heretofore suggested, to put the vessels now owned in the best condition of which they are susceptible, so that by increasing the strength of our naval squadrons, and thereby giving protection to our commerce, we may hereafter be in a condition to enlarge the Navy to such extent as our national necessities shall require. Whenever the condition of the Treasury will justify appropriations for the purpose, it is supposed that, instead of the large and expensive ships which the European powers are now building, our necessities may be, in a great measure, if not entirely, met by well-constructed vessels, well-designed and swift marine rams, and improved torpedo-boats, endowed with such qualities and built in such numbers, at comparatively small cost, as our existing necessities may demand. Experiments in these are suggesting their great value as the means of aggressive warfare, and there is fair promise that they will, in the course of time, supersede the expensive naval architecture which so enormously swells the cost of some of the largest ships. Heavy armor-plated, gun-bearing vessels are not capable of sea-service. They are suited for but little else than harbor defense, and may be likened to movable fortifications. And if it shall result that the use of them shall be dispensed with to make place for improved ships, rams, and torpedo vessels, then the Navy can become sufficiently effective if supplied with fast-sailing and fast-steaming vessels of different classes, built, as they are now built elsewhere, to serve in time of peace as schools of instruction for our seamen, and in time of war to destroy the commerce of an enemy. Until these experiments are fully made it would be an improvident expenditure of public money to build large and expensive ships, or to go far beyond putting our present naval force in the best condition of which it is susceptible. Whenever Congress shall deem it expedient to direct such tests as shall develop the importance and value of these modes of construction, beyond those now within reach of the department, no efforts will be spared to make them as effective as possible.

ESTIMATES AND EXPENDITURES.

The amount of appropriations applicable to the current expenses for the fiscal year ending June 30, 1877, were $14,488,974.33. The actual expenses during that period were $14,074,113.27. This, however, does not include the amount due to the officers and men of the Navy for the months of April, May, and June of that year, or the other items of the amount appropriated in the deficiency bill passed at the recent extra session of Congress, viz, $2,003,861.27. This, added to the aforesaid sum expended, will make $16,077,974.54 chargeable to the expenditures of that year. As will appear elsewhere in this report, there are claims against the department, chargeable also to that year. These are submitted to Congress; and whatsoever amount is appropriated therefor, added to the foregoing, will show the total current and other expenses of the year. Of the unexpended balance on hand June 30, 1877, there remains $271,792.83 which stand to the credit of the Bureaus of Equipment and Recruiting, of Yards and Docks, of Ordnance, and of Navigation.

The appropriations available for the present fiscal year, commencing July 1, 1877, are $13,592,932.90. The whole amount drawn from the Treasury from July 1 to November 1, 1877, is $5,343,037.40. Of this amount there is estimated to have been in the hands of paymasters and agents of the government on November 1, 1877, $876,953.53, besides $152,574.77 refunded, making a total of $1,029,528.30, which, deducted from the amount drawn, will show the actual expenditure from July 1 to November 1, 1877, to have been $4,313,509.10.

The following statement will show the amount drawn and the amount chargeable to expenditure for each of the months since July 1, 1876:

Exhibit of expenditure chargeable to Navy appropriations.

Date.	Drawn.	Refunded.	Expended.
Appropriations for 1876–'77.			
1876.			
July	$2,438,048 84	$3,260 50	$2,434,788 34
August	1,661,681 14	20,425 43	1,641,255 71
September	2,304,514 52	25,128 75	2,279,385 77
October	1,475,512 69	111,789 26	1,363,723 43
November	1,410,557 90	18,794 59	1,391,763 31
December	1,262,050 66	63,836 33	1,198,214 33
1877.			
January	1,363,814 13	574,916 94	788,897 19
February	1,050,991 73	281,546 42	769,445 31
March	1,215,548 86	80,756 77	1,134,792 09
April	433,279 93	112,697 00	320,582 93
May	385,903 40	39,158 04	346,745 36
June	431,762 18	27,242 68	404,519 50
	15,433,665 98	1,359,552 71	14,074,113 27
Appropriations for 1877–'78.			
1877.			
July	1,584,059 44	6,874 59	1,577,184 85
August	1,022,070 04	13,007 57	1,009,062 47
September	1,344,384 27	17,481 61	1,326,902 66
October	1,392,523 65	115,211 00	1,277,312 65
	5,343,037 40	152,574 77	5,190,462 63

1877.	
July 31. Appropriation warrant No. 301, 1878	$13,388,059 90
July 31. Appropriation warrant No. 302, 1878	153,000 00
Naval asylum, Philadelphia, Pa., 1878	51,873 00
	13,592,932 90

NAVY-PENSION FUND.

The following is a statement of the number and yearly amount of pensions on the rolls June 30, 1877, and the amount which was paid during the fiscal year:

	On roll June 30, 1877.	Annual amount of roll.	Amount paid for pensions during fiscal year ended June 30, 1877.
Navy invalids	1,722	$195,748 33	$200,227 13
Navy widows and others	1,717	283,910 00	327,723 40
Total	3,439	479,658 33	527,950 56

The estimates for the present fiscal year are $16,233,234.40, exclusive of $2,314,231, submitted for new buildings, repairs, and improvements at the several navy-yards, as will appear by the following table:

Estimates.

Pay of the Navy	$7,350,000 00
Pay of civil establishment in navy-yards	239,734 50
Ordnance and Torpedo Corps	633,386 00
Coal, hemp, and equipment	1,000,000 00
Navigation and navigation supplies	126,000 00
Hydrographic work	60,300 00
Naval Observatory, Nautical Almanac, &c	61,500 00
Repairs and preservation of vessels	2,250,000 00
Steam-machinery, tools, &c	1,000,000 00
Provisions and clothing, and small stores	1,330,660 00
Repairs of hospitals and laboratories	51,200 00
Surgeons' necessaries and naval-hospital funds	148,000 00
Contingent expenses of department and bureaus	279,000 00
Naval Academy	192,444 40
Support of Marine Corps	871,970 50
Naval asylum, Philadelphia, Pa	64,434 00
Maintenance of yards and docks	574,605 00
	16,233,234 40
To which may be added amount estimated and submitted for new buildings, repairs, and improvements for navy-yards and stations	2,314,231 00
Total	18,547,465 40

It is supposed that the appropriations for the present fiscal year were not designed by Congress to be applied to the construction of ships other than those in progress and contemplated at the time these appropriations were made. With this understanding, the department has felt itself bound only to proceed with the construction of the Nipsic, at Washington, and the Galena, at Norfolk, both of which were in such condition that any further delay would impair their value and increase the cost of their final completion. It is hoped that the Nipsic will be finished and ready for sea within this fiscal year, and the Galena within three months thereafter. It is not contemplated to enter upon the building of any new ships within the year, or to proceed with the Mohican unless Congress shall direct it. The appropriations of the present fiscal year, therefore, will be applied to the ordinary expenses of the service and to such repairs of vessels as are rendered absolutely necessary. As to the latter, it is often impossible to estimate them until after the work of repairing has been begun. The removal of decayed timber which is visible, and which creates the necessity for repairs before it is safe to send a ship to sea, sometimes exposes other decayed parts which were not visible, and which necessarily increase the cost of the work. And it has sometimes happened, and may so do again, that when the exposed timbers are removed and latent defects seen for the first time, the entire stripping of a ship becomes necessary to put it into a safe and reliable condition. The loss of a ship and its whole crew might be the consequence of sending it to sea without being in this condition.

PAY OF THE NAVY.

Referring to my report laid before Congress at the late extra session, I desire to repeat that the deficiency then existing in this fund has been a continuing one, and is not chargeable to any particular year. It is difficult to arrive at its precise condition at the end of any one of the past years; nor is it now considered material to do so, in view of the fact that whatever of deficiency has existed in the past runs forward and enters into the present ascertained balances. For the purpose, however, of enabling Congress to understand its condition fully, I have caused to be prepared the accompanying table, showing the condition of the fund from 1803 to 1877. In explanation of this table, it is proper to say that it is designed to show the sums annually appropriated, and the distribution among the disbursing-officers, whose accounts are rendered to the Fourth Auditor and settled by that officer and the Second Comptroller. These settlements have been made up to June 30, 1877, and show that the money has been faithfully disbursed and accounted for, except the ascertained defalcations, which have been reported to the proper department for judicial proceedings.. The table, however, does not show the deficiency of the fund, inasmuch as it is designed, of necessity, to be in the nature of a bank-account, showing merely the aggregate debits and credits of the fund and not the balances due by or to it at any particular time. The deficiency can only be ascertained by the books of the Fourth Auditor's Office, and the accounts of the disbursing-officers filed there, which alone show the amounts actually due and unpaid. Therefore, the amount recommended to and appropriated by Congress at the late extra session was arrived at in this mode, as this department had no other method of ascertaining it.

In order to remove, as far as possible, the difficulties and inconveniences which have existed in reference to this fund, so that hereafter Congress may more easily and correctly ascertain its amount from time to time, I have requested the Treasury Department to open a separate account of the disbursement of the amount appropriated by the act of November 21, 1877, in order to prevent it from being mingled with the general appropriation for pay of the Navy. If it were so placed as to become a part of this general fund it would hereafter be impossible to ascertain, without very great labor, whether the estimated deficiency reported to the extra session of Congress was or was not correct; whereas, by the proposed method of keeping the account, both the Treasury and Navy Departments will be, at any time, enabled to ascertain the precise amount to which this appropriation is applicable. And if, by this means, it shall be ascertained that the amount is less than that required to pay all the officers and men for the last quarter of the last fiscal year, the fact will be known; and if it shall be in excess of that amount, the surplus can be turned into the general appropriation for pay of the Navy. Apart from this, it will relieve the specific fund from all such embarrassment that each year's appropriation will be expended as designated by law; and if Congress shall authorize the Treasury Department to open such an account as will enable the Secretary of the Navy to draw upon a general fund for all purposes connected with the ocean service other than pay of the Navy, it is believed that this practice may hereafter relieve the latter fund from depletion, so that it will be at all times easy to ascertain its precise condition. The practice of permitting all expenses of vessels abroad, of whatever kind, to be paid out of pay of the Navy, and awaiting the settlement of paymasters' accounts in the Treasury Department before the amounts necessary to restore the fund to its proper condition can be transferred from the funds appropriated to the several bureaus, may have resulted from unavoidable necessity. But, whether this is so or not, it is desirable that it shall be changed, and the plan I have suggested be adopted, as not only due to the officers and men of the Navy, but because it will furnish a more satisfactory method of keeping the separate accounts and of complying more fully with the law.

In the report of the Secretary of the Navy of November 29, 1876, the estimated amount for pay of the Navy for the present fiscal year was $7,300,000, the computation being based upon the number of officers and men then borne upon the register. Congress, however, by the act of March 3, 1877, appropriated only $6,600,000, or $700,000 less than the estimate. This will necessarily produce a deficiency at the end of the fiscal year unless Congress shall appropriate the above amount, the payment of which to the officers and men is so fixed by law that it cannot be evaded. The amount appropriated for deficiency at the extra session of Congress had reference only to the last fiscal year ending June 30, 1877, and was based upon the amount ascertained to be due upon the books of the Fourth Auditor's office, whereas the deficiency here referred to is estimated for the present fiscal year, ending June 30, 1878.

NAVAL ACADEMY.

The department takes great pleasure in expressing its high appreciation of this admirable institution, not only on account of the educational advantages it offers, but because of the care and diligence displayed in its management by the officers in whose charge it is placed. The country looks to it for the future supply of its naval officers, and the excellent methods of study and discipline adopted give assurance that there will be found among the cadets many of eminent fitness. The whole corps of officers in charge of the institution are, in every sense, competent to discharge their duties. The graduating class at the June examination, consisting of 43, exhibited gratifying proficiency in all their professional studies, and its members are now serving their terms of two years at sea, as cadet-midshipmen, preparatory to taking the rank of midshipman in the Navy. From the accompanying report of the board of visitors for the last year it will appear that they speak in the most commendatory terms of the institution, and present several important recommendations, which are entitled to the consideration of Congress. There are now in attendance 276 cadets. Of these, there are 213 cadet-midshipmen and 63 cadet-engineers.

NAVAL CONSTRUCTORS.

One disadvantage under which the government has labored in building ships has been occasioned by its neglect to educate its ship builders. Instead of preparing its own officers for this purpose by proper professional training, which could have been done at comparatively small cost, it has had to rely mainly upon those who could be withdrawn from the merchant service. The evil is diminishing somewhat, and it is hoped that it will, in the course of time, be entirely removed. The subject is one of the greatest importance, and has received so much attention from the English Government that several of its eminent naval constructors have been knighted for their services. In France, none are permitted to enter this corps who have not been pupils in the first class of the polytechnic school. These, as well as other governments, have realized the positive necessity of educating these officers at the public expense; and their experience, no less than our own, has proved that ships of war cannot be safely or economically constructed by those who have not been professionally educated for that purpose. An improperly designed ship may compromise the honor of the country. No skill or intrepidity of the officers and men can remedy a serious defect in construction, and when it exists the total loss of a ship may be the una voidable consequence.

It is believed that we would soon be supplied with a sufficient number of competent Naval constructors by selecting them from the young men who enter the naval Academy and show an aptness or predeliction for mathematical and mechanical studies. There are many who enter there whose natural taste lies in this direction, and to whom such studies would be more attractive than those purely nautical. They enter the Navy for life, and have to be provided for by the government. If, therefore, a certain number of cadet-midshipmen, willing or desirous of entering the corps of naval constructors, and most proficient in the studies before named, should pursue, for two years at least, a course of study exclusively devoted to the object to be attained, that is, to mathematics and their application to mechanics, descriptive geometry, drawing, with kindred subjects, connected with their future profession, a corps of naval architects, fully competent for planning and constructing the best ships, would, in a few years, be supplied. The time now devoted to gunnery, astronomy, and other studies necessary to officers who go to sea, could be engaged in developing their mathematical and mechanical talents. The application of mathematics to the stability of floating bodies, and the other general theoretical principles, can be perfectly taught by the professors of the academy; and, this foundation being laid, the intelligent student can readily pursue them in the channels that will gradually open before him.

From the Academy the cadet should be sent to a navy-yard, where, under the further tuition of an experienced naval constructor, his progress would be continued. After becoming familiar with the practical operations of the yard, and with the use of materials and tools, he would be prepared to become a constructor.

By means of such a system of professional training as this, it is believed that the law which now authorizes the appointment of assistant constructors from the cadets of the Naval Academy would be attended with practically beneficial results. As it now is, such selections are necessarily made from among those who are educated specially for sea-service and steam-engineering; whereas the plan suggested requires the method of professional education to have reference to the object to be attained—the construction and building of ships. This important subject is recommended to the consideration of Congress, and is deemed worthy of its serious consideration. These suggestions can be readily elaborated into a practical plan.

NAVY-YARDS.

The estimates for the several navy-yards cover such amounts only as are supposed to be absolutely indispensable to keeping them in good condition. Repairs to docks and buildings become necessary more or less each year, and it is believed that the sums asked for are the least demanded by these and other uses indicated in the schedule of estimates. So much money has already been expended at these yards, and so essential are they to the maintenance of the Navy, that it would be bad economy to permit them to go into decay and the large amount of property accumulated in them to be wasted.

KITTERY YARD.—No new improvements have been made during the last fiscal year. The appropriations for repairs and preservation were barely sufficient, with the practice of rigid economy, to make such repairs as were most urgent.

The excellence of the machinery and workshops at this yard; the abundance of skilled labor in its immediate vicinity; the healthfulness of its climate, which has caused it to be selected as the port to which vessels of war suffering from the pernicious climate of the West Indies and Mexico shall be ordered for sanitary purposes or for repairs, all conspire to recommend it to the fostering care of Congress. The amount of appropriations asked for is small, and is urgently needed.

BOSTON YARD.—No new works have been erected at this yard within the year. An appropriation for building a boundary wall on the southwest side of the yard, for the protection of the large amount of public property stored in its vicinity, is asked for. The new floor for the rope-walk is a necessity, and the cart-shed, yards and docks' workshop, the paving, grading, and railway tracks are much needed. The rope-walk at this yard is the only Government rope-walk in the country; and the excellence of its hemp, manilla, and wire rope and hawsers is universally acknowledged. This yard is a very important one. It contains a large quantity of the best machinery, and possesses one of the three stone dry-docks on the Eastern coast.

NEW YORK YARD.—No new works have been erected during the year. The small allotment it was possible to make from repairs and preservation has been economically and judiciously applied, and the yard is in as good repair as could be expected, under the conditions of inadequate appropriations.

Upon my visit to this yard I was disagreeably surprised at the dilapidated state of that valuable piece of property known as Cob-dock. This dock has been reclaimed from its original condition of a mud-bank, by the zeal and energy of naval officers and seamen. It is now second only in importance to the navy-yard itself; and if something be not speedily done to arrest its decay it will gradually but surely slide back to its original condition, encumber the channel with its acres of mud, and the work of years will be entirely lost to the government. It is hoped that Congress will see the present urgent necessity of saving this reclaimed land, and of rendering it of greater value to the country. The estimates for improvements at this yard are small, and the timber and coal sheds, the crib-work and fire-engine house are objects of prime necessity.

By the act of February 26, 1877, (16 U. S. Stat. at Large, p. 239, chap. 66,) the President was authorized to organize a commission of three members, who were required to arrange equitable terms for the conveyance to the city of Brooklyn of a portion of this yard, situate in Wallabout Bay, for a public market. By the act it was provided that when the commission, or a majority of its members, shall report their conclusions to the Secretary of the Navy, it shall be his duty to lay them before Congress, at its first session thereafter, and shall make and deliver to the city of Brooklyn a sufficient deed of conveyance for the land described in the act, or such part as the commissioners may recommend for sale. This commission has been organized, but has thus far made no report; in view of which fact I deem it my duty to say that, from a personal inspection of the premises, I have reached the conclusion that this important navy-yard would be very seriously injured by this sale. If it is to be preserved in such condition as will answer the public demands at this important point, its territorial limits should not be reduced. In the near future every available foot of ground within its walls will be needed for wet-docks, workshops, timber-sheds, and other public buildings.

It is not supposed that Congress intended the act referred to as an absolute sale, and that the deed of conveyance should be made upon the report of the commission without further inquiry. In that event the conveyance would be a matter of form merely. But, if it be otherwise, and Congress still retains full power over the matter, it may yet, in its discretion, decide whether or no the property shall be sold. The subject is worthy of consideration.

New London Yard.—Little beyond grading a portion of the site granted by the State of Connecticut to the Navy Department has been done at this yard during the past year. The large wharf, built some time ago, and the storehouses are in good condition. As it has not yet been finally determined by Congress whether the site shall be retained by the government for the purposes designed by the conveyance from the State, and as no appropriation was made for the present fiscal year, it was not deemed expedient to embrace any in the estimates for the next year.

The land conveyed to the government is situated upon the bank of the Thames River, contains eighty-three acres, and has a mile of available water-front. A board of competent naval officers reported, in 1862, that the harbor has a safe and reliable entrance from the ocean, and is accessible at all times and seasons. It is well protected from violent winds and heavy seas, and is not obstructed by ice. As a strategic point it is of great importance to the defense of the city of New York, the commerce of Long Island, and the whole coast of Connecticut. Batteries or monitors could easily prevent an enemy from penetrating the harbor. It is, in fact, so well adapted to all the purposes of a navy yard, that its claims for continued appropriations are worthy the consideration of Congress.

League Island Yard.—The sum of $402,417.41, allotted to the Bureau of Yards and Docks during the last fiscal year, out of the sum realized from the sale of the Philadelphia navy-yard, has all been expended in the erection of buildings, wharves, and causeways, and in grading and filling in. All the principal work has been done by contract. The remainder of the $1,000,000, to wit, $597,582.59, was expended by the Bureaus of Steam-Engineering and Construction and Repair for purposes pertaining to those bureaus.

The appropriations for this yard are specially recommended to the consideration of Congress. League Island, from its geographical proximity to the iron and coal fields of Pennsylvania, from its situation in the immediate vicinity of Philadelphia, whence labor, skilled in all the mechanic arts, can be drawn, must eventually become one of the most important navy-yards in the country. Entirely secure from attack by an enemy, it will become important to collect at this yard stores of material which, in the event of a foreign war, it might be deemed unsafe to stock at yards more exposed to bombardment. And establishments should be erected here whenever the condition of the Treasury will warrant it, with all the machinery and appurtenances for manufacturing all the various articles which go to make up a vessel of war.

WASHINGTON YARD.—No appropriation for improvements was made for this yard for the last fiscal year. The importance of it, however, cannot be lost sight of. Although small, it is thoroughly equipped and in good condition. Every effort has been made to keep the workshops in a good state of repair; but during the fiscal year ending June 30, 1876, by special act of Congress, no part of the appropriation for repair and preservation was allowed to be used for that purpose, and consequently large repairs are now needed.

This yard possesses a large quantity of the best machinery. It is here that all the copper for the Navy is rolled, and that chains and anchors are made. As a manufacturing yard it has not its equal in the country. No estimate for new buildings has been made, and it is hoped that the whole sum asked for under repairs and preservation will be granted.

NORFOLK YARD.—No new works were undertaken at this yard during the last year. The limited amount of accommodation for the storage and protection of timber is a source of great loss and inconvenience. Estimates have been made for two timber-sheds, and these will only partially remedy the evil. A chain and cordage store for the Bureau of Equipment and an engine-house are much needed; and $20,000 for the extension of the quay-wall, an improvement of great importance, have also been estimated for, and an appropriation for each object is recommended.

The site of this yard was selected many years ago, by competent and far-seeing naval officers, and has proved to be all anticipated by them. Work can be carried on there at all seasons of the year, and it may be said to be inaccessible to an enemy. Skilled labor is procured there without difficulty and to any extent required. Taking all these and other conditions into account, Norfolk cannot fail to be one of the most important naval stations if properly fostered by Congress.

The propriety of constructing a fresh-water basin in which iron-clad vessels may be laid up, protected from the corroding influences of salt water, and kept ready to move at the shortest notice, has for some time been under the consideration of the department. In September last a board of experienced civil engineers was ordered to Norfolk navy-yard, for the purpose of selecting a site, in the immediate vicinity of the yard, where such a basin as was deemed necessary could be constructed, in the event of its sanction by Congress. The department, in selecting this point for such a basin, was governed by its knowledge of the existence of fresh-water streams in that vicinity, by the central position of the yard, and by its temperate climate. The report of the board, together with a plan of the proposed basin and site, with estimates of the probable cost, is herewith laid before Congress for its consideration.

PENSACOLA YARD.—No appropriations were made for new improvements at this yard during the last fiscal year. The yard is reported to be in a fair state of repair. It is now the only point south of Norfolk where repairs can be made to a vessel of war. But the means at command are very limited. A machine-shop for steam-engineering has been estimated for, and also a timber-shed. Both these are objects of imperative necessity.

In the possible event of hostilities in the Gulf of Mexico, the Pensacola navy-yard would become of the first importance. All the Gulf squadron would necessarily resort there for repairs. There is no good reason why it should not become, in the future, a building as well as a repairing yard. Its proximity to the live-oak reservations would render that costly material cheaper there than at the more northern yards, as the long water carriage would be avoided; and it has the excellent iron and coal of Southern Alabama almost at its gates.

An iron dry-dock, already contracted for, is in progress of construction, and is designed for this yard. It is the intention of the department to have it towed to the yard as soon as the proper season for doing so shall arrive and it can be safely attempted.

It is represented to the department that apprehensions are entertained by the citizens of Pensacola that the navigation of the bay may be seriously if not irreparably injured by the injudicious unloading ballast from ships upon blocks or cribs sunk in deep water to receive it. These structures are temporary in their nature, but they leave large deposits, whereby the depth of the water in the bay is diminished, thus interfering with the approach of shipping to the shore. Their tendency is to change the currents by the creation of artificial islands, and to throw the sand from points of the land into the deeper waters of the bay. Not only is se ious injury thereby threatened to the commerce of the port, but the entry of national vessels into the harbor endangered. In view of this fact it is well worthy the consideration of Congress.

Mare Island Yard.—The only new work in progress at this yard is the stone dry-dock. For the past fiscal year $50,000 was appropriated, and has been expended chiefly for taking care of the work already completed, and in laying masonry. In the present unfinished condition of the dock, it is peculiarly liable to injury from a variety of causes, but no appropriation for continuing the work was made for the present fiscal year. The dock has, consequently, been cared for from the small appropriations made for the Bureau of Yards and Docks. An appropriation of $400,000 for the purpose of continuing this important and necessary improvement, to be made immediately available, is recommended.

I cannot too strongly urge the necessity of this appropriation; and desire also to call special attention to the estimate for dredging and scowing. For maintaining a proper depth of water in the vicinity of the wharves and at the landings, dredging is indispensable.

Reports from the late commandant at Mare Island show a great decrease in the depth of water at the docks, and unless some radical measures are promptly adopted, it will soon be impracticable to bring a vessel of even moderate draught of water alongside the dock. I consider all the objects estimated for necessary and economical. As the only navy-yard upon the Pacific coast, it is unnecessary to dilate upon the great value of that at Mare Island. Situated, as it is, behind the defenses of San Francisco—having that growing and important city to draw upon for skilled labor and material of all kinds—and being the only port at which our vessels of war from the North and South Pacific can be properly repaired, its importance cannot be overestimated.

TORPEDOES.

The long list of casualties during the late war, as well as many failures, have stimulated invention in devising improved methods of attack and defense. In 1869 a torpedo school was established at Newport, and upwards of 170 officers of all grades, from captain to ensign, have attended the practical exercises and instruction in chemistry and electricity. A very complete course of the chemistry of explosives, and of electricity as applied to signalling and lighting, and to exploding subaqueous mines by contact, automatically or at the will of the operator, has been established. The experience of the war and suggestions of numerous officers have been embodied, and the subject is well advanced, so far as defense is concerned, either of ships from attack or of harbors or passes.

The importance of these experiments is demonstrated by the fact that electric signals from a cordon round a vessel, or moored in channels, denote an approaching adversary, and indicate his movements even in fogs or darkness. They, moreover, enable an operator to fire guns laid in advance, or explode at will any torpedo within the radius of whose destructive effect the enemy may pass, while the electric light renders his movements visible.

The offensive modes of indirect attack have not made so much progress, being confined thus far to direct methods of attack with small vessels or launches, partaking of the nature of a forlorn hope, and with little chance of success against a watchful enemy provided with suitable means of discovery and defense. These offensive torpedoes are the "outrigger," devised by Fulton; the towing-torpedo; the self-contained locomotive-torpedo, such as the small cigar-shaped boats used during the war, and those launched from a ship or boat, trusting to accuracy of direction; and, finally, the controlling torpedoes of Lay and Ericsson, and those improvised from the ship's ordinary steam-launches fitted with electric cables for steering; these, for the present, are the most effective methods of attack. And it is believed that the experiments now in progress in reference to these will result in most important improvements.

With our limited number of ships and great extent of coast the development of this subject is of the highest importance, as we offer numerous vulnerable points in our deep bays and broad sounds, which cannot be closed to an enterprising enemy by any system of fortifications or subaqueous mines operated from the shore. Suitable armored torpedo-boats will be necessary adjuncts to our monitors and other systems of defense. But the whole subject is yet in such an inchoate state that extensive experiments will be necessary to determine the best methods and familiarize officers and men with their use. These experiments are comparatively inexpensive, and since it is only by practice that skill and confidence in the use of the powerful explosives can be obtained, I recommend the appropriations asked for the bureau having charge of this important and interesting subject.

TRAINING SYSTEM.

Under section 1418 of the Revised Statutes, boys between sixteen and eighteen years of age are authorized to be enlisted in the Navy to serve until twenty-one years of age. With a view to secure practically the good effects of this provision, the department has had in operation for two years a training system for the purpose of introducing a class of well-trained young seamen into the Navy to take the place of the old men-of-wars-men, who are fast disappearing, as well as gradually to man our ships of war with American citizens who appreciate their relations to the government, and will be always ready to defend its honor and its flag. By this mode we shall be enabled to give to our naval service a more distinctive national character, such as it has hitherto very much lacked, in so far as the enlisted men are concerned. At present there are 458 of these boys under training, and 324 have passed out of the training-ships into the general service. The English government has availed itself of this method of training its seamen, and its navy has derived material benefits from it. Already the system has worked so satisfactorily in our Navy that it is very desirable it should receive whatever advantages can be given it by additional legislation. As the Navy has been reduced by act of Congress to the low standard of 7,500 men, if Congress should empower the department to enlist 750 boys annually, in addition to the present allowance of enlisted men, for the foregoing purpose, the beneficial effects of it would soon be manifest. This number annually enlisted will eventually man the Navy, keep it supplied with seamen in time of peace, and form the nucleus of a larger force should it become necessary, in time of war. The annual cost of this number of boys would not exceed $90,000, chargeable to the pay of the Navy, a cost comparatively nominal in view of the advantages which would inure to the service and the country from this system of training.

BANKING SYSTEM.

A law of Congress, approved May 15, 1872, established a system of deposits in the Army for the savings of the soldiers. It authorizes the payment of 4 per cent interest upon all sums of $50 and upward deposited with any paymaster in the Army, under certain restrictions and subject to certain conditions. I respectfully suggest to Congress the necessity of so extending the operations of this law as to include the appointed and enlisted men and boys and marines of the Navy. The operation of the law, as reported by the Secretary of War, has been of the most beneficent character, reducing desertion, and improving the tone and morale of the Army. A similar law is also in force in the British army and navy, with like gratifying results. The payment of this interest would probably not require more than $25,000 annually.

HYDROGRAPHIC OFFICE.

During the last fiscal year the work of the hydrographic office has progressed steadily and satisfactorily. And, although much yet remains to be done to place this important branch of the Bureau of Navigation in a position to supply all the demands of the naval and commercial marine, it is able at present to furnish the greater part of the charts, sailing-directions, &c., required for commerce. This office has a most favorable position with regard to similar offices abroad, and is relied on almost entirely by those connected with our own commerce. For the work done during the year, with the recommendations made for the future, I refer to the report of the chief of the Bureau of Navigation and that of the hydrographer.

NAVAL OBSERVATORY.

This institution continues to deserve the highest consideration of the country and of the scientific world on account of its steady progress in all the branches intrusted to its care. Under the management of its able corps of professors, it has already taken rank among the most distinguished observatories in the world, and promises such future usefulness as commends it to the approbation and fostering care of Congress.

The location of the observatory exposes it to unhealthy influences, the effects of which have already been witnessed in the impaired health of its occupants. It is very desirable that it should be changed to some more suitable point, which may be more economically done while the buildings are becoming dilapidated, than at some future period after the money necessary to put them in a good state of repair has been expended.

It has been supposed that it would be advantageous to change the plan of its management, by removing it from the control of the Navy Department and establishing it as a National Observatory, under an independent organization. I have conferred upon this subject with the present superintendent and the corps of professors, and communicate herewith their opinions. While they are not all united as to the propriety and expediency of this suggestion, a majority think that the public interests require that the change should not be made. In this opinion I concur, believing that, for the present at least, it would be unwise to disturb it.

VOLUNTEER ASSISTANT SURGEONS.

The medical corps of the Navy consists of 15 medical directors, 15 medical inspectors, 50 surgeons, and 100 assistant surgeons, as fixed by law. Section 1411 of the Revised Statutes gave to the Secretary of the Navy power to appoint, for temporary service, such acting assistant surgeons as the exigencies of the service may require. Under this act a number of appointments have been made from time to time, and some of the appointees have been transferred into the regular corps of the Navy. The Navy appropriation act approved July 15, 1870, provided (sec. 13) for the repeal of all laws authorizing the appointment of temporary acting officers in the Navy, except as to these assistant surgeons. As I suppose this act to take away from the Secretary of the Navy the power to dispense with the services of any of these assistant surgeons, and as 22 of them are now in office, whose services are not required, the matter is submitted to Congress, to decide whether or no they shall remain longer in office and be paid for services which are not performed and which are not likely to be required in time of peace.

PURCHASE OF IRON.

Attention is called to the suggestions in the reports from the Bureaus of Steam-Engineering and Equipment and Recruiting in reference to the purchase of iron for boilers, chains, &c. As the law now stands, the department, after publication, is required to award contracts for iron to the lowest responsible bidder. After the contract is thus awarded it has sometimes occurred, and is likely to occur again, that upon subjecting the iron to the necessary government test it is found not to answer the purposes for which it is designed. When this occurs a new contract has to be made, after another publication, which occasions great and sometimes injurious delay, with the possible repetition of the same state of facts. An instance of the kind recently occurred. The Bureau of Steam-Engineering advertised for proposals for boiler-iron, and specimens were furnished after the award of the contract which, upon actual test, have failed to come up to the requirements. The contract, consequently, has not been entered into, and, unless it is made with the lowest bidder, cannot be without further advertisement. The result is that great delay has ensued, which is without remedy within the authority of the department. And there is no guarantee that the same thing may not be repeated.

The necessity for having the very best iron for boilers and chains must be recognized by all. The use of inferior material for either of these purposes might and probably would be attended with the most serious consequences—either the bursting of a boiler or the parting of a chain. By the former, many lives might be sacrificed and a vessel seriously injured; by the latter, a ship and its crew might be lost at sea.

There can be but one remedy for this condition of things, which is to allow the purchase of iron for naval purposes, whenever it can be obtained, with a view to the peculiar qualities requisite for the purposes for which it is required. The iron-board at the Washington navy-yard is constantly engaged in testing the iron of any manufacturer who may desire it, and authority should be given to the department to purchase such as has passed the test established in the most satisfactory manner, at its market-value. If it should be the pleasure of Congress to amend the existing law so as to authorize this, such restrictions could be adopted as would secure a satisfactory ascertainment of the market-value and sufficiently guard against imposition. Private purchases of any material for public use should not be authorized, except in cases of absolute necessity. But this seems to constitute such an exception to the rule that it might be adopted without any impairment of the rule itself. It is believed that where so much depends, as it regards life and property, upon the kind of iron used in the Navy, its quality and fitness should not be left dependent upon the private interests of those engaged in its manufacture. Safety and security require the preservation of the government test, and where these cannot be reached by the manufacturer who may become the lowest bidder under an advertisement, the department should be allowed, upon its public responsibility, to procure the material needed, according to the test, wheresoever it can be procured at a fair market-price.

SEAMEN'S CLOTHING.

All enlisted privates in the Army and in the Marine Corps are furnished with clothing, at the time of their enlistment, at the public expense, and without any charge to them. It is otherwise with enlisted seamen. The price of the clothing of each enlisted seaman is charged to him at the date of his enlistment, and the amount necessary to repay the cost to the Government is deducted from his pay, in proportionate monthly amounts. This is considered by them as oppressive, and finding themselves thus brought in debt, it is the frequent cause of desertion. If they were placed upon the same footing with the soldiers and marines their services would be more cheerfully rendered, and the number of desertions would be reduced. This matter is especially recommended to Congress.

INDEBTEDNESS.

On March 1, 1877, the indebtedness of the Bureau of Steam-Engineering to sundry individuals and companies, for balances due upon contracts made before that time

For machinery, boilers, &c., was	$1,454,694 33
For materials, stores, &c., was	206,852 75
Total	1,661,547 08

On March 3, 1877, contracts were made by the department for work on account of the iron-clads Puritan, Monadnock, Terror, and Amphitrite, aggregating $1,165,000, each of which contained a provision that no portion of the money should be paid until appropriated by Congress.

Contracts were also made March 7 and March 10, 1877, for boilers for the Tuscarora, Narragansett, Snowdrop, and Dictator, amounting to

$331,621.09, making a total indebtedness of this bureau March 10, 1877, $3,158,168.77. As there was no money appropriated by Congress subject, by law, to be applied to payments of work done under the contracts made subsequent to March 1, 1877, these contracts were suspended, and the order of suspension has not been revoked.

To the above aggregate of indebtedness should be added, for necessary purchases, &c., from March 1 to July 1, 1877, the sum of $5,747.29, making the total indebtedness of the Bureau of Steam-Engineering to July 1, 1877, $3,163,915.47.

The indebtedness of the Bureau of Construction and Repair, as ascertained up to March 1, 1877, was, upon bills in requisition of Navy paymasters, $185,680; accrued bills not drawn, $83,558.71; for labor at navy-yards, $27,949.76; and bills held by parties, and available only after an appropriation to meet the same was made by Congress, $547,609.64 Large quantities of timber had been contracted for, part of which had been delivered and another part was to be thereafter delivered. That part to be delivered was contracted for by orders from the bureau, which, having been issued when there was no money on hand to pay the bills and without advertisement and competition, were all suspended. The department, having no reason to believe that the parties who held these orders were acting otherwise than in good faith, and not being disposed to act oppressively toward them, consented that in all cases where they had the timber *in transitu* at the time of the suspension, it might be delivered at the respective navy-yards for storage, with the understanding that the question whether or no the contracts, to that extent, should be recognized or disallowed, should be submitted to Congress. If recognized, and the money appropriated and paid, the timber will become the property of the United States. The whole amount covered by timber already delivered, and that included in these orders, is $287,503.31. There are also other claims against this bureau, arising within the time mentioned, amounting to $303,854.82, of which the department has had notice. The aggregate of all these demands, therefore, is $1,436,156.23, including the price of the timber stored after the suspension of the orders.

There were contracts made by the department, March 3, 1877, for work to be done by this bureau, for the completion and fitting the iron-clads Puritan, Monadnock, Amphitrite, and Terror, amounting to $2,103,642. There being at that time no money available in payment of these contracts, a provision was inserted in them that no payments should be made under them until appropriations applicable to the purpose were made by Congress. I deemed it my duty, also, to suspend these contracts, inasmuch as I regarded them as not authorized by law, and to submit to Congress to decide whether they shall be recognized or canceled, and, if these vessels are to be completed, in what manner it shall be done. Finding no present appropriation applicable to that purpose, I do not regard the department as possessing any discetionary power in reference to them except to see that the interest the government has in them is properly protected. If the amount covered by these contracts is to be charged against the Bureau of Construction and Repair, then the whole amount of its actual and conditional indebtedness will be $3,539,798.23.

A contract was made by the department February 8, 1877, for the impregnation and preservation of timber, for which it was agreed to pay $14,000 for one hundred thousand feet of timber, and beyond that quantity four cents per cubic foot, with further conditions in reference to the execution thereof. This contract was also suspended for the same reason as those referred to above, and is not therefore embraced in the foregoing estimate of indebtedness, as the amount to be paid under it, if executed, is indefinite.

The indebtedness of the Bureau of Provisions and Clothing on March 1, 1877, for bills for provisions, was $55,846.31; for clothing, $385,189.08; for small stores, $28,500; and for freight, $3,935.91; making a total of $473,471.30. It is due to the management of this bureau, however, to say that there was due to it on account of clothing issued and checked against pay of the Navy $339,200.23, and that it was indebted to pay of the Navy, on account of purchases and expenses of store-houses abroad, $225,742.77, for clothing, $3,489.05, and for contingent expenses, $4,548.30, making a total of $233,780.12. So that, in striking the balance between this bureau and pay of the Navy, the latter fund remains in debt to it $105,420.11, for which there has been no transfer. The bureau has also unsettled balances with the other bureaus and the hospital fund, as follows: the other bureaus are indebted to it in the sum of $8,779.80, while it is indebted to them and the hospital fund $4,946.96, leaving $3,832.84 in its favor. If these adjustments were all made between the bureaus it would, therefore, reduce the indebtedness of this bureau to $364,218.35. But as all the money appropriated for the last fiscal year has been expended, and no portion of that appropriated for the present fiscal year is applicable to the adjustment of these balances, the indebtedness of the bureau cannot be relieved in any other way than by the appropriation of the whole amount of $473,471.30 by Congress.

If the sums covered by these suspended contracts be held as chargeable against the Bureaus of Steam-Engineering and of Construction and Repair, the total indebtedness of the three bureaus is $7,083,503.25. If the amounts covered by the conditional contracts with the Bureau of Steam-Engineering and that of Construction and Repair be held as not so chargeable, then the indebtedness will be reduced to $3,483,240.16. And it is proper to say, in reference to these conditional contracts, that the iron-clads they were designed to complete have already cost the government large sums of money, and that it would be bad economy to abandon them in their present condition. It is certainly desirable that they should be finished as speedily and economically as possible;

but the Secretary of the Navy has no authority to do this in the present condition of the appropriations, or without the direction of Congress. If the conditional contracts shall be approved, or new ones authorized, and the necessary appropriations be made, the measures necessary to secure their speedy completion will be adopted. If Congress shall decide to leave them in their present condition, the department will employ all the means it possesses to take care of and preserve them.

The adjustment of all these claims and demands, in such manner as Congress shall direct, will relieve the department from pecuniary embarrassment, and enable all its affairs to be so conducted that the appropriations for the present fiscal year can be applied as directed by law; and every effort will be made to secure such a result during the year that there shall be no deficiency at its end. Whatsoever Congress directs to be done will be accomplished if possible, and whatsoever it does not direct will not be attempted.

Respectfully,

R. W. THOMPSON,
Secretary of the Navy.

To the PRESIDENT.

SUPPLEMENT.

VESSELS OF THE UNITED STATES NAVY.

November 10, 1877.

Name of vessel.	Condition.	Displacement.
1ST RATES.		
		Tons.
Colorado	Receiving-ship, New York	4,700
Franklin	Receiving-ship, Norfolk	5,170
Minnesota	Training-ship, New York	4,700
Niagara	Ordinary, Boston	5,440
Wabash	Receiving-ship, Boston	4,650
2D RATES.		
Connecticut	On the stocks, Boston. (Not worth finishing, being of white oak, and much decayed.)	4,450
Florida	Laid up, New London	4,220
Iowa	Laid up, Boston. (Very rotten, not worth repairing, and should be sold.)	4,000
Tennessee	Flag-ship, Asiatic Station	4,840
Antietam	Store-ship, League Island	4,000
Java	On the stocks, New York. (Not worth finishing, being of white oak, and much decayed.)	4,000
New York	On the stocks, New York	4,070
Pennsylvania	On the stocks, Boston. (Not worth finishing, being of white oak, and much decayed.)	4,000
Susquehanna	Ordinary, New York. (Not worth repairing; should be sold)	3,980
Lancaster	Laid up, Kittery	3,250
Brooklyn	Laid up, New York	3,000
Pensacola	Flag-ship, North Pacific	3,000
Hartford	Flag-ship, South Atlantic	2,900
Richmond	Under repairs, Boston	2,700
Congress	Ordinary, Kittery. (Of white oak, and very rotten; should be sold).	3,050
Worcester	Laid up, Norfolk. (Of white oak, and very rotten; should be sold).	3,050
Trenton	Flag-ship, Europe	3,900
Powhatan	Flag-ship, North Atlantic	3,980
Alaska	Under repairs, New York	2,400
Benicia	Under repairs, Mare Island	2,400
Omaha	Flag-ship, South Pacific	2,400
Plymouth	North Atlantic Station	2,400
Lackawanna	North Pacific Station	2,220
Ticonderoga	Under repairs, Kittery	2,220
Canandaigua	Under repairs, Norfolk	2,130
Monongahela	Asiatic Station	2,100
Shenandoah	Ordinary, New York	2,100
3D RATES.		
Juniata	Laid up, Norfolk	1,900
Ossipee	North Atlantic Station	1,900
Quinnebaug	Building, League Island	1,900
Swatara	North Atlantic Station	1,900
Galena	Building, Norfolk	1,900
Vandalia	European Station	2,080
Marion	do	1,900
Mohican	Building, Mare Island (work on, suspended)	1,900
Iroquois	Laid up, Mare Island	1,575
Wachusett	Under repairs, Boston	1,575
Wyoming	Receiving-ship, Washington	1,560
Tuscarora	Under repairs, Mare Island	1,560
Kearsarge	Asiatic Station; on the way home	1,550
Adams	South Pacific Station	1,375
Alliance	European Station	1,375
Essex	South Atlantic Station	1,375
Enterprise	North Atlantic Station	1,375
Nipsic	Building at Washington	1,375
Ashuelot	Asiatic Station	1,370
Monocacy	do	1,370

Vessels of the United States Navy—Continued.

Name of vessel.	Condition.	Displacement.
		Tons.
Narragansett	Ordinary, Mare Island	1,235
Alert	Asiatic Station	1,020
Huron	North Atlantic Station. (Since wrecked)	1,020
Ranger	Asiatic Station	1,020
Kansas	Ordinary, Kittery. (Very rotten and not worth repairing)	900
Saco	Ordinary, Mare Island. (Very rotten and not worth repairing)	900
Nyack	Ordinary, Mare Island. (Very rotten and not worth repairing)	900
Shawmut	Ordinary, Norfolk. (Very rotten and not worth repairing)	900
Yantic	Ordinary, Washington	900
Michigan	In commission, Lake Erie	685
4TH RATES.		
Frolic	Ordinary, Washington. (This vessel too old and expensive; should be sold.)	1,300
Gettysburg	Special duty, Mediterranean	1,100
Tallapoosa	Despatch vessel	1,270
Palos	Asiatic Station	420
Despatch	Special service, Europe	....
Rio Bravo	Rio Grande River	....
SAILING-VESSELS.		
New Hampshire	Port Royal	4,150
New Orleans	On the stocks, Sacket's Harbor. (Not worth finishing, being much decayed.)	4,200
Ohio	Ordinary, Boston	4,250
Vermont	In use, at New York, by Equipment Bureau	4,150
Virginia	On the stocks, Boston. (Ordered to be broken up; work suspended)	4,150
Constellation	Laid up, Annapolis; used as a practice-ship	1,886
Constitution	Training-ship, Philadelphia	2,200
Independence	Receiving-ship, Mare Island	3,270
Sabine	Ordinary, Kittery. (Unfit for further service; should be sold)	2,450
Santee	Gunnery ship, Annapolis	2,430
Savannah	Ordinary, Norfolk; fitted for ordnance store-ship	2,330
Portsmouth	On her way from Mare Island to an Atlantic navy-yard	1,125
Cyane	Ordinary, Mare Island. (Unfit for further service; should be sold)	950
Jamestown	Marine school-ship, San Francisco, under act June 20, 1874	1,150
3D-RATES.		
Saratoga	Training-ship, Hampton Roads	1,025
Saint Louis	Receiving-ship, League Island	830
Saint Mary's	Marine school-ship, New York	1,025
Dale	Instruction ship, Annapolis	675
Pawnee	Used for storing coal, Port Royal	1,650
Guard	Astronomical service, Atlantic Ocean	925
Onward	Store-ship, Callao	704
Relief	Receiving-ship, Washington	468
Supply	Training-ship. (Out of commission at New York)	547
IRON-CLADS.		
Ajax	In commission, Sandy Point, James River, Virginia	2,100
Amphitrite	Building at Wilmington, Del.; work suspended	3,815
Canonicus	At New Orleans, North Atlantic Station	2,100
Camanche	Ordinary, Mare Island	1,875
Catskill	In commission, Sandy Point, James River, Virginia	1,875
Colossus	On the stocks, New York. (White oak, decayed in part, and not worth finishing.)	....
Dictator	Ordinary, League Island	4,500
Jason	......do	1,875
Lehigh	In commission, Sandy Point, James River, Virginia	1,875
Mahopac	In dock, Norfolk, repairing	2,100
Manhattan	Waiting repairs, Norfolk	2,100
Massachusetts	On the stocks, Kittery. (White oak, decayed in part, and not worth finishing.)	....
Miantonomoh	Building at Chester, Pa	3,815
Monadnock	Building at Vallejo, Cal	3,815
Montauk	In commission, Washington Yard	1,875
Nahant	In commission, League Island	1,875
Nantucket	In commission, Annapolis	1,875
Oregon	On the stocks, Boston. (White oak decayed in part, and not worth finishing.)	....
Passaic	In commission, Washington	1,875
Puritan	Building at Chester; work suspended	....
Roanoke	At Chester, Del. (Condemned, and ordered to be broken up)	....
Saugus	In commission, Washington	2,100
Terror	Building at Philadelphia; work suspended	3,815
Wyandotte	In commission, Washington	2,100

Vessels of the United States Navy—Continued.

Name of vessel.	Condition.	Displacement.
TORPEDO-BOATS.		
		Tons.
Intrepid	In commission, New York	1,150
Alarm	In commission, Newport	800
TUGS.		
Blue Light	Laid up, New London; condemned. (Should be sold at auction)	
Catalpa	In running order, New York	
Cohassett	Ordinary, Boston	
Emerald	Ferry-boat, Kittery	
Fortune	In commission	
Glance	In commission, League Island	
Jean Sands	In commission, yard-tug, Norfolk	
Leyden	Repairing, Boston	
Mayflower	At Annapolis	
Monterey	Yard-tug, Mare Island	
Nina	Torpedo duty, Newport	
Phlox	In use, Naval Academy	
Pilgrim	Ordinary, League Island	
Pinta	Attached to North Atlantic Station	
Rescue	Ordinary, Washington	
Rocket	Repairing, New York	
Rose	Yard-tug, Pensacola	
Snowdrop	Yard-tug, Norfolk	
Sorrel	Ordinary, League Island; recommended to be sold	
Speedwell	Ordinary, Kittery	
Standish	Laid up, Norfolk	
Spuyten Duyvil	Laid up, New York	
Triana	Under repairs, Washington	
Wyandank	At Annapolis	
Grapeshot	Yard-tug, New York	
Seaweed	Port Royal	
Burlington	Ferry-boat, ordinary, League Island	

Navy appropriations and expenditures, 1803 to 1877.

	Date of act making the appropriation.	Reference to the Statutes at Large.			Amount of annual appropriation.	Year of expenditure.	Expenditure by warrants.	Repayments.	Amount carried to the surplus fund.	Net expenditures.
		Volume.	Page.	Section.						
PAY AND CONTINGENCIES.										
PAY OF THE NAVY.										
Transferred from "Naval Department"					$100,000 00					
For pay and subsistence of officers and pay of seamen	Mar. 2, 1803	2	208	1	183,993 00	1803	$243,993 00		a$40,000 00	$243,993 00
	Jan. 31, 1804	2	249	1	234,328 00	1804	234,328 00			234,328 00
	Jan. 25, 1805	2	310	1	415,578 00	1805	415,578 00			415,578 00
	Apr. 21, 1806	2	398	1	291,119 00	1806	291,119 00			291,119 00
	Jan. 7, 1807	2	411	1	296,048 00					
	Nov. 24, 1807	2	450	1	74,754 29	1807	370,802 29			370,802 29
	Feb. 10, 1808	2	466	1	368,048 00	1808	368,048 00			368,048 00
	Mar. 3, 1809	2	546	2	1,323,077 60	1809	950,000 00			950,000 00
	Mar. 2, 1810	2	562	1	718,115 00	1810	580,000 00		b110,000 00 c15,000 00	580,000 00
	Feb. 7, 1811	2	616	1	774,390 00	1811	818,500 00	$4,696 95	b120,000 00	813,803 05
	Feb. 4, 1812	2	685	1	1,123,341 00	1812	1,081,745 20	1,625 25	b200,000 00 c70,000 00	1,080,119 95
	Mar. 3, 1813	2	821	1	2,033,000 00	1813	1,727,100 10			1,727,100 10
	Mar. 19, 1814	3	105	1	2,579,341 00					
For bounty and pay of seamen for the year 1814	Apr. 18, 1814	3	139	4	122,700 00	1814	1,808,193 23	252 33	d200,000 00	1,807,940 90
For the pay and subsistence of officers and pay of seamen	Mar. 3, 1815	3	223	1	1,538,364 50	1815	2,538,364 50			2,538,364 50
	Apr. 24, 1816	3	299	1	1,142,015 00	1816	1,142,015 00			1,142,015 00
	Mar. 3, 1817	3	382	1	1,092,732 00	1817	1,092,732 60			1,092,732 00
	Mar. 18, 1818	3	411	1	1,135,595 00	1818	1,135,595 00			1,135,595 00
	Feb. 16, 1819	3	483	1	986,372 75	1819	986,372 75			986,372 75
	Jan. 14, 1820	3	540	1	273,100 00					
	Mar. 17, 1820	3	553	1	989,320 00	1820	1,262,420 00			1,262,420 00
	Mar. 3, 1821	3	634	1	983,325 25	1821	983,325 25			983,325 25
	May 4, 1822	3	676	1	400,000 00	1822	400,000 00			400,000 00
	May 4, 1822	3	676	1	561,466 00	1822	536,690 24	165,389 86		371,300 38
	Mar. 3, 1823	3	763	1	929,503 12	1823	978,635 31	73,980 88		904,654 43
	Apr. 29, 1824	4	20	1	847,142 25	1824	1,101,421 46	203,005 96		898,415 50
Pay and subsistence of officers and pay of seamen other than those at navy-yards, shore-stations, and in ordinary	Feb. 21, 1825	4	83	1	783,554 37	1825	943,373 24	107,320 76		836,052 48
	Mar. 14, 1826	4	140	1	908,595 50					
	Apr. 5, 1826	4	152	1	66,897 00	1826	1,144,473 03	118,504 47		1,025,968 56
	Mar. 2, 1827	4	207	1	1,112,392 25	1827	1,278,973 38	106,355 19		1,172,618 19
	Mar. 19, 1828	4	254	1	1,176,312 00					

For pay, subsistence, and provisions	May 24, 1828	4	313	....	35,160 00	1828	1,370,363 27	159,303 71	....	1,211,059 56
For pay and subsistence of officers and pay of seamen employed in the Navy afloat	May 24, 1828	4	311	1	294,078 00	......	....	....	....	....
For pay and subsistence of officers and pay of seamen other than those at navy-yards, shore-stations, and in ordinary	Mar. 2, 1829	4	354	1	918,514 00	1829	1,297,109 06	137,040 97	....	1,160,068 09
For pay and subsistence of officers and pay of seamen of frigate Brandywine	Dec. 29, 1829	4	370	...	36,378 00	......	....	....	....	....
	Jan. 30, 1830	4	371	....	136,922 61	......	....	....	....	....
For pay and subsistence of officers and pay of seamen	Mar. 11, 1830	4	375	....	1,463,449 00	1830	1,381,086 53	254,608 90	....	1,126,477 63
	Mar. 2, 1831	4	460	1	1,278,694 00	1831	1,649,133 58	145,242 63	....	1,503,890 95
	Feb. 24, 1832	4	498	....	1,409,927 00	1832	1,448,157 68	114,104 35	....	1,334,053 35
	Feb. 20, 1833	4	614	1	1,445,000 00	1833	1,435,472 89	86,604 40	....	1,348,868 49
	Jan. 24, 1834	4	670	....	1,487,244 21	1834	1,698,834 60	91,631 59	....	1,607,203 01
	Feb. 13, 1835	4	750	....	1,501,824 42	1835	1,464,491 61	88,599 30	....	1,375,892 31
For additional pay to the officers of the Navy and the civil establishments of the navy-yards, granted by act of the present session of Congress	Mar. 3, 1835	4	770	1	295,732 74	......	....	....	....	....
For pay of commissioned, warrant, and petty officers and seamen	May 14, 1836	5	27	1	2,318,017 16	1836	1,841,191 00	52,869 56	*e*70,000 00	1,788,321 44
	Mar. 3, 1837	5	155	1	2,454,686 00	1837	2,404,045 52	180,239 80	....	2,223,805 72
	May 31, 1838	5	232	1	1,312,000 00	1838	2,366,706 14	260,617 16	*f*265,000 00	2,106,088 98
	Mar. 3, 1839	5	362	1	2,352,625 64	1839	2,487,001 46	198,793 97	....	2,293,207 49
	July 20, 1840	5	398	1	2,250,000 00	1840	2,624,307 31	95,721 49	....	2,528,585 82
	Mar. 3, 1841	5	419	....	2,335,000 00	1841	2,615,507 92	323,354 91	....	2,292,153 01
	Aug. 4, 1842	5	500	....	2,335,000 00	1842	2,675,793 27	131,521 39	....	2,544,271 88
For pay of officers and seamen for half fiscal year	Mar. 3, 1843	5	615	...	1,496,584 50	1843	1,609,865 54	333,224 37	....	1,276,641 17
For pay of commissioned, warrant, and petty officers and seamen	Mar. 3, 1843	5	615	...	2,715,808 00	1844	3,210,186 94	216,941 30	....	2,993,245 64
	June 17, 1844	5	699	1	2,509,189 00	1845	2,917,634 93	412,518 63	....	2,505,116 30
	Mar. 3, 1845	5	790	1	2,509,189 00	1846	2,997,261 07	490,694 06	....	2,506,567 01
	Aug. 10, 1846	9	97	1	3,571,735 00	1847	2,847,445 40	791,604 93	....	2,055,840 47
	Mar. 3, 1847	9	169	1	3,305,156 00	1848	4,770,684 06	360,784 11	....	4,409,899 95
Transferred from Provisions	....	....	......	...	48,547 61	......	....	....	....	....
Increase, repair, armament, and equipment of the Navy	....	....	......	...	235,000 00	......	....	....	....	....
Mexican hostilities	....	....	......	...	835 43	......	....	....	....	....
Navy-yard, Portsmouth, N. H	....	....	......	...	44,000 00	......	....	....	....	....
Navy-yard, Philadelphia	....	....	......	...	42,000 00	......	....	....	....	....
Navy-yard, Pensacola	....	....	......	...	60,000 00	......	....	....	....	....
Surgeons' necessaries, &c., for the sick and hurt, including Marine Corps	....	....	......	....	10,000 00	......	....	....	....	....
Testing Earle's patent	....	....	......	....	5,000 00	......	....	....	....	....
Testing inventions for preventing explosions of steam-boilers, &c	....	....	......	....	1,000 00	......	....	....	....	....
Pay of the Marine Corps	....	....	......	....	40,000 00	......	....	....	....	....
Fuel for Marine Corps	....	....	......	....	10,000 00	......	....	....	....	....
Provisions for Marine Corps	....	....	......	....	10,000 00	......	....	....	....	....
And the following, transferred to the Department of the Interior and retransferred, viz:										
From Invalid Pensions	....	....	......	....	36,000 00	......	....	....	....	....
Pensions to widows and orphans of persons lost in the schooners Sea Gull and Grampus	....	....	......	....	6,189 72	......	....	....	....	....

a Transferred to "Naval Department."
b Transferred to "Repairs of vessels."
c Transferred to "Contingent expenses."
d Transferred to "Building sloops of war," &c.
e Transferred to "Provisions," $40,000; "Pay and subsistence of Marine Corps," $30,000.
f Transferred to "Repairs of vessels," $150,000; "Medicines," &c., $10,000; "Contingent expenses," $105,000.

Navy appropriations and expenditures, 1803 *to* 1877—Continued.

	Date of act making the appropriation.	Reference to the Statutes at Large.			Amount of annual appropriation.	Year of expenditure.	Expenditure by warrants.	Repayments.	Amount carried to the surplus fund.	Net expenditures.
		Volume.	Page.	Section.						
PAY AND CONTINGENCIES—Continued.										
PAY OF THE NAVY—Continued.										
For pay of commissioned, warrant, and petty officers and seamen	Aug. 3, 1848	9	266	1	$2, 192, 211 00	1849	$3, 158, 635 88	$379, 872 38	$336, 457 22	$2, 778, 763 50
	Mar. 3, 1849	9	374	1	2, 462, 500 00	1850	3, 096, 208 72	706, 821 94		2, 389, 386 78
	Sept. 28, 1850	9	513	1	2, 758, 262 00	1851	3, 122, 677 70	313, 499 33		2, 809, 178 37
	Mar. 3, 1851	9	621	1	2, 771, 448 00	1852	2, 820, 830 23	263, 427 51		2, 557, 402 72
	Aug. 31, 1852	10	100	1	2, 771, 698 00	1853	3, 309, 369 84	265, 203 26		3, 044, 166 58
	Mar. 3, 1853	10	220	1	2, 880, 148 00	1854	3, 151, 014 77	296, 494 41		2, 854, 520 36
	Aug. 5, 1854	10	583	1	3, 367, 648 00	1855	3, 729, 073 30	334, 110 57		3, 394, 962 73
	Mar. 3, 1855	10	675	1	3, 515, 111 00	1856	4, 046, 783 39	552, 487 56		3, 494, 295 83
	Aug. 16, 1856	11	44	1	3, 421, 718 00	1857	3, 761, 106 14	560, 508 49		3, 200, 597 65
	Mar. 3, 1857	11	243	1	3, 855, 450 00	1858	4, 087, 680 37	558, 800 76		3, 528, 879 61
	June 12, 1858	11	314	1	3, 805, 405 00					
For pay of officers, restored to the Navy, during their retirement and suspension	Mar. 3, 1859	11	404	1	62, 394 00	1859	4, 095, 082 96	690, 872 51		3, 404, 210 45
For pay of commissioned, warrant, and petty officers and seamen	Mar. 3, 1859	11	404	1	3, 930, 439 00					
	June 22, 1860	12	83	2	39, 400 00	1860	4, 677, 385 36	509, 510 66		4, 167, 874 70
	June 22, 1860	12	80	1	4, 574, 725 97					
	Feb. 21, 1861	12	147	1	4, 438, 577 00	1861	6, 081, 538 34	1, 075, 340 51		5, 006, 197 83
	July 18, 1861	12	266	1, 2	7, 179, 200 00	1862	8, 958, 677 80	776, 108 69		8, 182, 569 11
	July 14, 1862	12	561	1	11, 617, 109 00					
	Mar. 3, 1863	12	814	1	14, 734, 332 70	1863	13, 353, 128 16	850, 751 14		12, 502, 377 02
	May 21, 1864	13	80	1	19, 423, 241 00	1864	22, 362, 921 64	2, 282, 960 16		20, 079, 961 48
For pay of commissioned, warrant, and petty officers and seamen, including the Engineer Corps of the Navy	Mar. 2, 1865	13	462	1	23, 327, 722 50	1865	29, 831, 792 78	2, 342, 328 02		27, 489, 464 76
						1866	13, 637, 419 49	4, 992, 217 88	*a*245, 904 12	8, 645, 201 61
For pay of commissioned, warrant, and petty officers and seamen	Apr. 17, 1866	14	33	1	9, 336, 638 00	1867	12, 415, 433 81	3, 392, 042 49		9, 023, 391 32
	Mar. 2, 1867	14	489		10, 826, 280 00	1868	11, 996, 787 65	3, 034, 151 91	4, 000, 000 00	8, 962, 635 74
	June 17, 1868	15	68	1	8, 000, 000 00	1869	11, 828, 025 76	3, 298, 457 39		8, 529, 568 37
	Mar. 1, 1869	15	276	1	7, 000, 000 00	1870	8, 069, 616 20	1, 658, 039 30		6, 411, 576 90
For pay of commissioned and warrant officers, for mileage or transportation of officers traveling under orders, and for pay of petty officers and seamen, including men for engineer force	July 15, 1870	16	321	1	7, 000, 000 00	1871	8, 321, 140 75	1, 259, 730 31		7, 061, 410 44
						1872	2, 177, 560 30	855, 418 47	4, 460 91	1, 322, 141 83
For pay of officers at sea, on shore, on special service, on retired list, &c	Mar. 3, 1871	16	526	1	6, 500, 000 00	1872	7, 440, 001 64	1, 087, 784 33	852 53	6, 352, 217 31
	May 23, 1872	17	145	1	6, 250, 000 00	1873	8, 389, 274 45	2, 347, 858 71		6, 041, 415 74
	Mar. 3, 1873	17	547	1	6, 250, 000 00					

For pay of the Navy	Dec. 31, 1873	18	2	....	300,000 00	1874	11,747,478 08	4,247,659 68	....	7,490,818 40
For pay of commissioned and warrant officers at sea, on shore, on special service, &c.	June 6, 1874	18	53	1	6,250,000 00	1875	8,931,258 75	2,485,934 82	....	6,445,323 93
	Jan. 18, 1875	18	297	1	6,250,000 00	1876	9,393,399 05	3,159,977 94	....	6,233,421 11
Total	....	....	......	....	264,972,664 49	......	309,517,381 07	50,280,524 31	5,677,680 78	259,236,856 76
Balance	....	....	......	....	....	......	....	....	58,126 95	
For pay of the Navy	June 30, 1876	....	......	....	5,750,000 00	1877	7,603,452 40	690,545 76	b108,938 07	....
For pay of the Navy, deficiency	Mar. 3, 1877	....	......	...	1,000,000 00	......	....	....	....	....
For pay of the Navy, difference between furlough and waiting orders	Mar. 3, 1877	....	......	....	227,183 43	......	....	....	....	....
Grand total	....	....	......	....	271,949,847 92	......	317,120,833 47	50,971,070 07	5,786,618 85	271,936,382 25
Balance									13,465 67	
The actual Treasury balance is									13,424 98	
Difference (this difference is occasioned by two outstanding warrants for that sum)									40 69	

a Transferred to "Contingent expenses."

b (?)

DETAILED MOVEMENTS OF VESSELS.

NORTH ATLANTIC STATION.

The force on this station is still under the command of Rear-Admiral S. D. Trenchard, and now consists of the Powhatan, (flag-ship,) 17 guns; Plymouth, 12 guns; Swatara, 8 guns; Ossipee, 8 guns; Enterprise, 6 guns; and the tugs Pinta and Seaweed. The New Hampshire and Pawnee still continue as store-ships at Port Royal, S. C. The iron-clads Ajax, Catskill, Lehigh, Manhattan, and Mahopac, at the anchorage in James River, Virginia, or preparing at Norfolk to go there, and the Montauk, Passaic, and Wyandotte, at Washington, are in semi-commission in reserve for sea-service. The iron-clad Canonicus remains in commission off New Orleans. The iron-clads Dictator and Saugus were put out of commission—the Dictator June 1, at League Island, and the Saugus October 8, at Washington. The Hartford, Adams, Alliance, Essex, Ranger, and Shawmut were attached to this station at different times during the year. The flag of Rear-Admiral Trenchard was transferred from the Hartford to the Powhatan July 4, and the first-named vessel was sent to the navy-yard, Norfolk, to be fitted as the flag-ship of the South Atlantic station. On the 20th of August Rear-Admiral Trenchard shifted his flag, temporarily, while the Powhatan was being repaired, to the Plymouth, and afterward to the Ossipee, and hoisted it again on the Powhatan October 2. While the Swatara was off Washington, during the labor-strike in July, his flag was also temporarily hoisted on that vessel.

The Hartford, as flag-ship, sailed on a cruise to the West Indies from Hampton Roads March 28, and touched at Bridgetown, Barbadoes, Saint Pierre, Martinique, Saint Thomas, Santa Cruz, and Matanzas, and arrived at Port Royal, S. C., May 28. She left there on the 30th and reached Hampton Roads, Virginia, June 4. On the 10th of July she went to the navy-yard, Norfolk, to be prepared as the flag-ship of the South Atlantic station. (See South Atlantic.) The Powhatan arrived at Hampton Roads July 2, from Annapolis, Md., and Rear-Admiral Trenchard's flag was hoisted on her July 4. On the 20th of August she was sent to the Norfolk navy-yard for repairs. She left that yard October 13, Rear-Admiral Trenchard's flag having been hoisted on the 2d of October, and anchored in Hampton Roads; departing thence on the 22d for New York, she arrived at that port October 23, and leaving on the 12th November, she returned to Hampton Roads the 14th.

The Plymouth left Hampton Roads December 23, 1876, and arrived at the navy-yard, Pensacola, the 9th of January following. Sailing thence on the 8th of February and passing through Eads jetties and works on the 9th, she anchored off New Orleans and remained until April 3, when she steamed up the Mississippi River as far as Vicksburg, stopping at Donaldsonville, Baton Rouge, and Natchez. She returned to New Orleans May 9. On the 19th she left that port, reached Pensacola on the 21st, and sailed thence on the 24th, arriving at Vera Cruz, Mex., June 1. Leaving that place after about a month's stay, she reached Port Royal July 1. She arrived at Norfolk as convoy for the iron-clad Mahopac on the 11th, and on the 22d left, and anchored off Alexandria, Va., on the 23d. When the services of this vessel were no longer needed in connection with the labor-strike, she sailed August 18 for New York, where she remained until September 30, when she left Hampton Roads, arriving there October 2. On the 8th went to the

Norfolk yard to be calked, and on November 19, left Hampton Roads for St. Thomas and a cruise in the West Indies.

The Swatara left the navy-yard, New York, February 5, and arrived at the Norfolk yard on the 9th. On the 12th she left, and anchored in Hampton Roads. On the 12th of March she sailed for Aspinwall, via Puerto Plata, touched at the last-named-place, and arrived at Kingston, Jamaica, on the 29th, on her way to Aspinwall; which place she reached April 9. She remained there until June 14 following, when, after having made a visit to San Andres Island, she sailed for Port Royal, touching at Key West on the 22d, and reaching Port Royal on the 29th. On the 30th she left, convoying the iron-clad Catskill, and arrived at Norfolk with her on July 4. On the 21st she left Hampton Roads, and anchored off the navy-yard, Washington, on the 23d. When her services were no longer needed in connection with the labor-strike, she sailed August 11 for Hampton Roads, where she arrived on the 12th. On the 12th of September she left for New York, and reached the navy-yard there on the 14th. On the 23d of October she left New York for Hampton Roads, reaching there the 25th.

The Ossipee left New Orleans February 9 and arrived at Pensacola February 11. On the 19th of March she sailed for Cuba, and after cruising off that coast she came to Key West, arriving there on the 10th of May. On the 15th she arrived at Port Royal, and convoyed the iron-clads Ajax and Manhattan in June following to Norfolk, arriving there with the last-named on the 23d of June. On the 12th of September she left for New York, and reached there the following day. After cruising as far as Portland, Me., in October, she returned to New York on the 19th of that month, and departed thence on the 29th for Hampton Roads, reaching there on the 31st, and on the 8th November went to the Norfolk yard for repairs to her engines.

The Enterprise was put in commission at the navy-yard, Portsmouth, N. H., March 16. On the 11th of August she sailed, and reached Hampton Roads on the 14th. On the 27th she arrived at the Norfolk navy-yard, remained there for repairs, and left Hampton Roads on the 22d November for New Orleans, for surveying duty in that harbor.

The Huron arrived at Port Royal December 4, 1876, and on the 18th of March, 1877, proceeded on a cruise to the north coast of South America, touching at St. Thomas, Port au Spain, Trinidad, visiting many places off Venezuela, and arriving at Puerto Cabello May 12. On the 15th of June she arrived at Aspinwall, and at Key West, Fla., July 2. On the 22d she arrived at the navy-yard, Norfolk, and on the 26th off the navy-yard, Washington. When her services were no longer required in connection with the labor-strike, she sailed August 11 for Hampton Roads, arriving on the 12th and leaving on the 15th for the New York navy-yard, which place she reached on the 28th. On the 15th November she left New York, and arrived at Hampton Roads on the 17th. On the 23d she left for the West Indies, for duty connected with telegraphic longitude and for general cruising, and on the 24th, at about 1.30 a. m., she was wrecked off Nag's Head, coast of North Carolina.

The Adams arrived at Port Royal in November, 1876, left on the 10th of March, 1877, and reached the navy-yard, Norfolk, on the 12th. On the 19th of April she sailed for the South Atlantic station. (See South Atlantic.)

The Alliance was put in commission at Norfolk January 18, 1877, arrived at Hampton Roads February 16, and on the 9th of March sailed to join the European station. (See European.)

The Essex sailed January 31 from the navy-yard, Norfolk, for Vera Cruz and the coast of Mexico, and arrived at Key West on the 16th February, and off Vera Cruz on the 20th. She remained on this cruise till May 8, when she sailed for Key West, arriving on the 16th; departing thence she reached Port Royal on the 22d. On the 2d of June she left Port Royal, convoying the iron-clad Lehigh, and arrived at Norfolk on the 5th. Returning to Port Royal, she left on the 16th, convoying the iron-clad Saugus, and reached Norfolk on the 19th. On the 16th of August she sailed on a cruise to Liberia and the west coast of Africa, and when last heard from, October 19, had arrived at Monrovia, Liberia; on the completion of this cruise she is ordered to join the South Atlantic station.

The Ranger arrived at Hampton Roads December 22, 1876. March 8, 1877, was detached from the North Atlantic station and ordered to New York, arriving there on the 10th. On the 19th of April left for the Asiatic station. (See Asiatic.)

The Shawmut was put out of commission at the navy-yard, Norfolk, on the 22d of January.

SOUTH ATLANTIC STATION.

The Adams is at present the only vessel on this station, although the Hartford, as flag-ship of Commodore E. T. Nichols, appointed to command the station, is now *en route.* The Essex is under orders to join this station, also, on the completion of her cruise to the west coast of Africa. The Richmond, bearing the flag of Commodore C. H. B. Caldwell, then commanding the station, left Rio de Janerio December 30, 1876, for St. Catharine's, Brazil, arriving at that port January 4, 1877; leaving there on the 22d, she reached Montevideo the 29th, and remained there until the 1st of May, and returning to Rio de Janeiro on the 16th. On the 26th of June the Richmond left Rio, and arrived at Hampton Roads on the 22d of August, remaining there till the 27th, when she sailed for Boston; reaching there on the 1st of September, she was put out of commission on the 18th.

The flag of Commodore E. T. Nichols, as commanding the United States naval force on the South Atlantic station, was hoisted September 17 on the Hartford, at Norfolk, and that vessel sailed October 13 for her station, and when last heard from, November 4, had arrived at Funchal, Madeira.

The Adams arrived at Rio de Janerio June 2, having left Hampton Roads, Virginia, on the 19th of April, and on the 13th of June left to search for Madeiras Rock. On the completion of this duty she returned to Rio, and on the 17th of July sailed for Bahia, returning from thence to Rio August 17. She has orders to leave this station about November 1, to join the South Pacific station.

The Frolic arrived at Montevideo January 31 from a cruise up the river, and on the 10th of February left for the same destination. On the 16th of March rendered assistance to the wrecked American ship Admiral, returning to Montevideo on the 26th, and remaining there until May 1, when she departed for Rio, reaching there on the 17th. On the 13th of June the Frolic accompanied the Adams in the search for Maderias Rock, and on the completion of this duty returned to Rio. On the 6th of September, in obedience to orders of the department, she left, and arrived at Hampton Roads October 19, and on the same day sailed for Washington, where she arrived on the 21st, and was put out of commission on the 31st.

EUROPEAN STATION.

The following vessels comprise the force on this station, which up to the 5th of October continued under the command of Rear-Admiral John L. Worden: Trenton (flag-ship), 11 guns; Vandalia, 8 guns; Marion, 8 guns; Alliance, 6 guns.

The Gettysburg and Despatch are also within the limits of this command on special service. The Trenton left New York March 8, 1877, arrived at Villafranca April 18, and Rear-Admiral Worden's flag was transferred to her from the Marion April 19. On the 9th of May she sailed for Smyrna, Turkey, and arrived there the 15th. On the 9th of June, in company with the Marion, left for Salonica, arriving there on the 10th. Finding matters quiet, departed on the 13th, and returned to Smyrna. She remained there until August 25, on which day she left, and reached Villafranca August 30, and on the 4th of September left for Marseilles. On the 18th left Marseilles and arrived at Villafranca the same day, and on the 5th of October, at that place, Rear-Admiral William E. Le Roy relieved Rear-Admiral Worden of the command, and the last-named officer returned to the United States.

The Vandalia sailed from Smyrna for Constantinople January 5, and arrived off that city on the 7th, remaining until the 8th of July, and arriving at Smyrna on the 9th. On the 22d she sailed for the coast of Syria, to visit Latakia, Tripoli, Beirut, Haifa, Joppa, and Port Said, and return to Beirut. On the 10th of October was ordered to Villafranca, where she was at last accounts.

The Marion left Villafranca for Smyrna April 19, and remained there until June 9, when she left, in company with the Trenton, for Salonica, and on the 13th returned to Smyrna. On the 8th of July she left, and arrived off Constantinople the following day. She received orders to proceed to Smyrna, and was there at last accounts, October 22.

The Alliance arrived at Villafranca April 17, having left Hampton Roads on the 9th of March, and on the 19th was ordered to the coast of Syria, to visit all the ports up to Latakia, and return to Beirut. She made that cruise, and returned to Beirut May 22, remaining there until July 11, when she departed for Smyrna, reaching that place on the 16th. She has orders to proceed on 25th August to Salonica, and, after remaining there a few days, to return to Smyna. Was at Constantinople at last accounts, October 22.

The Gettysburg, on special surveying duty in the Mediterranean, sailed on the 13th of March for Constantinople, under orders of Rear-Admiral Worden, and remained there for one month, when she returned to execute the special duty assigned her.

The Despatch left Hampton Roads May 1, arrived off Constantinople June 14, and is on special duty there.

NORTH PACIFIC STATION.

The force on this station continues under the command of Rear-Admiral Alex. Murray, and consists of the Pensacola (flag-ship), 22 guns, and the Lackawanna, 10 guns. The Pensacola remained at Panama since the last report of the Secretary of the Navy until the 4th of April, when she sailed, visiting Punta Arenas, Acapulco, San Blas, Mazatlan, and La Paz, and arrived at San Francisco July 1. While at Acapulco, Rear-Admiral Murray inquired into the arrest of the United States consul, and secured his release and a satisfactory termination of the whole affair. During the labor-strike, in July, the ship, in conjunction with the Lackawanna, rendered material assistance to the State authorities of California. She expected to sail on a cruise to the Sandwich Islands about the 1st of December.

The Lackawannna visited Guaymas, San Blas, and Mazatlan, arriving at the last-named place December 12, 1876. On the 28th sailed for La Paz, and on the 6th of January, 1877, left there for San Francisco, arriving on the 25th. On the 20th of March she sailed to Mazatlan, arriving there on the 6th of April, and investigated the cases of the schooners Dreadnaught and Montana; left there on the 22d and reached Acapulco May 3. On the 20th of May left for Mazatlan, arriving on the 24th, and leaving same day for San Francisco, stopping at Pichilinque, and reaching San Francisco June 25.

On the 25th of August she sailed from the navy-yard, Mare Island, for Puget Sound, on the request of the Secretary of the Interior that a United States vessel might be sent to the Indian reservation in that locality, and reached Neah Harbor, Washington Territory, on the 4th of September. Remained in that locality until about October 22, when she was ordered to return to San Francisco, and reached there November 13, and is under orders to survey Tartar Shoal, the locality of the wreck of the Pacific mail-steamship City of San Francisco, and cruise along the Mexican coast.

SOUTH PACIFIC STATION.

The vessels now in this station are the Omaha, 12 guns, and the Onward, store-ship, at Callao. The force is now under the command of Rear-Admiral George H. Preble, who assumed command at Panama, and hoisted his flag on the Omaha March 11. The Adams is under orders to leave South America about November 1 to join this station. The Omaha remained at Panama during the last year until May 5, 1877, when she sailed, and visited Guayaquil, Payta, Chimbote, and Callao, Peru; arriving at the last-named place June 14. While there, Rear-Admiral Preble conferred with the United States minister in relation to the steamer Georgia, and the steamer was released by the authorities. August 1 left Callao for a cruise southward as far as Valparaiso and Talcahuano, to stop at the intermediate ports and return to Callao about November 1; reached Valparaiso October 1, and intended to leave on the 22d, on return to Callao; is under orders to return to the United States, either to San Francisco, or by Cape Horn to an Atlantic port. The Onward remains as the store-ship at Callao.

ASIATIC STATION.

The force on this station, Rear-Admiral Thomas H. Patterson having assumed command on October 4, consists of the Tennessee (flag-ship), 23 guns; Ashuelot, 6 guns; Monocacy, 6 guns; Alert, 4 guns; Ranger, 4 guns, and Palos, battery of howitzers. Rear-Admiral William Reynolds, having been condemned by medical survey, left Yokohama on the 12th of August for the United States, leaving Captain Jonathan Young temporarily in command. The Kearsarge was attached to the station during the year, and the Monongahela, 11 guns, is now on her way.

The Yantic left Hong-Kong December 21, 1876, arrived at Norfolk May 18, 1877, and was put out of commission on the 30th. Rear-Admiral William Reynolds, then in command of the force on this station, turned over the command to Captain Young, the senior officer, August

12, and returned to the United States by passenger-steamship to San Francisco. The Tennessee left Yokohama December 17, 1876, and arrived at Hong-Kong on the 28th; left January 4, 1877, for Bangkok, and arrived at the mouth of Menam River, Siam, in company with the Ashuelot, on the 11th; remained there until the 31st, when she sailed for Singapore, reaching there February 4. On the 14th left, and arrived at Labuan, Borneo, the 19th, Manila on the 26th, and departed thence for Hong-Kong on the 28th, where she arrived March 3. On the 7th of April sailed for Yokohama, Japan; arrived there the 12th, and was there at last accounts. Is under orders to leave the station between the middle of February and middle of March and return to the United States.

The Ashuelot left Shanghai December 21, 1876, and arrived at Hong-Kong on the 25th; left, and arrived at the mouth of Menam River, Siam, January 11, and Bangkok on the 12th. On the 27th left Bangkok and Menam River the 31st; arrived at Saigon February 3, departed on the 8th, and reached Hong-Kong on the 19th. On the 13th of March sailed for Canton, and returned to Hong-Kong on the 31st. Left April 16, arrived at Canton same day, and on the 19th sailed with the United States consul and visited Noihon, island of Hainan, Naion, Pakhoi, island of Guiay Chu, newly-opened ports. Left the last-named place on the 30th, arrived at Hong-Kong May 2, and on the 4th departed for Canton, reaching there the 5th. Sailed on her way up the coast of China, and reached Swatow June 1. On the 3d of July arrived at Shanghai from Ningpo. On the 10th of August she left for Chefoo, where she was at last accounts.

The Monocacy visited till May 23, 1877, the new ports on the Yangtse River. On the last-named date she left Shanghai for Tientsin, stopped at Chefoo, and left there June 2, arriving at Tientsin on the 4th. On the 18th of July arrived at Chefoo from Tientsin. Left Chefoo August 14, arrived at Nagasaki the 17th, and on the 28th proceeded to Kobe and Yokohama, arriving at the last-named port September 1.

The Alert during the month of January was at Nagasaki, having arrived December 6, 1876, from Shanghai; she left on February 1, arrived at Kobe the 4th, and Yokohama the 9th. On the 12th of May left for Damphier Straits to search for shipwrecked persons reported to be on some of the islands in that vicinity, and, after a thorough search, finding the reports erroneous, proceeded to Hong-Kong, arriving there July 24. On the 29th left for Nagasaki, reaching that port August 6, and departing thence on the 10th for the scene of the wreck of the American vessel Roving Sailor, wrecked about forty miles from Yokohama. Arrived at Yokohama on the 15th; departed thence September 13 for Hakodadi, Vladivostock, Niigata, and Nagasaki, to touch at Lendai, Kamaishi, and Katakisi Bays to ascertain the correct position of the island north of Katakisi Bay.

The Ranger arrived at Singapore August 8, having sailed from New York April 19 to join the station; left August 11 and arrived at Hong-Kong on the 24th, and at Nagasaki September 8, and was at last accounts under orders to Shanghai.

The Palos was at Yokohama during the months of December, 1876, and January, 1877, and on the 12th of February left for Nagasaki, where she arrived March 3, having visited Kobe, departed thence on the 8th, and arrived at Ningpo the 11th. On the 19th left for Wenchow with the United States consul, and visited that place; returned to Ningpo March 30, and arrived at Shanghai April 7. On the 19th of June left for Nanking with the secretary of legation on board, stopped at Ching Kiang, and reached Nanking June 20; departed thence on the 30th, and returned to Shanghai July 2. In August, 1877, was ordered to proceed to the new ports of Ningpo, Poo-Foo, and Wenchow, and afterward to return to Shanghai.

The Kearsarge left Hong-Kong January 15 for Yokohama and Nagasaki, touching at all consular ports on the China coast as far as Ningpo. Arrived at Foochow February 4 from Amoy, Swatow, and Hong-Kong; arrived at Ningpo February 21 from Foochow, and at Nagasaki March 1. On the 24th of May departed thence for Kagosima, and returned on the 31st. Arrived at Kobe July 9 from Nagasaki, and on the 30th was ordered to the assistance of the steamship Oceanic, reported as having lost her screw in the vicinity of Van Diemen's Straits. Arrived at Hong-Kong August 9; departed thence on the 15th, and reached Nagasaki on the 22d, and was ordered to return to the United States (Boston) via the Suez Canal. Left Nagasaki September 3 and reached Hong-Kong on the 10th and Singapore on the 25th. On the 1st of October intended to leave for the island of Ceylon, *en route* to Boston, Mass., via the Suez Canal.

The Monongahela sailed from New York for the Asiatic station September 22, 1877, via the Mediterranean and Suez Canal, and arrived at Gibraltar October 25.

TRAINING-SHIPS, ETC.

The Minnesota, also the flag-ship, a part of the year, of Vice Admiral Rowan, port-admiral at New York, the Monongahela, a portion of the year, the Constitution, the Saratoga, and the Supply, tender to the Minnesota, have all been used as training-ships for enlisted boys in the Navy. The Constellation and Mayflower have made their usual cruises as practice-ships for cadet-midshipmen and cadet-engineers. The Gettysburg has continued on special duty in the Mediterranean. The Guard was put in commission at New York September 18, 1877, for special duty in Europe in connection with telegraphic longitude work, and left New York October 29 for Lisbon, Portugal. The Rio Bravo has remained on the Rio Grande River, Texas, and the Michigan on the lakes. The Speedwell has been on duty connected with the United States Fish Commission during the summer and until October 25, when she was put out of commission. The Tallapoosa has made her usual trip as dispatch vessel, to the several navy-yards.

APPENDIX.

No. 1.—ESTIMATES SECRETARY'S OFFICE.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, by the Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
SALARIES.		
Secretary, per act March 3, 1877 (R. S., p. 69, sec. 415; 19 Stat. at L., p. 311)	$8,000	
Chief clerk, per act March 3, 1877 (R. S., p. 69, sec. 416; 19 Stat. at L., p. 311)	2,500	
Disbursing-clerk, per act March 3, 1877 (R. S., p. 69, sec. 416; 19 Stat. at L., p. 311)	2,000	
Four clerks of class four, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 311)	7,200	
Three clerks of class three, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 311)	4,800	
One clerk of class two, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 311)	1,400	
Four clerks of class two (submitted)	5,600	
Two clerks of class one, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 311)	2,400	
Four clerks of class one (submitted)	4,800	
Two messengers, at $840 each, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 311)	1,680	
Two laborers, at $720 each, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 311)	1,440	
	$41,820	$31,420
CONTINGENT EXPENSES.		
Stationery, furniture, newspapers, and miscellaneous items (appropriated) (19 Stat. at L., p 312)	5,000	2,500
SALARIES, BUILDING.		
Superintendent, per act March 3, 1877 (R. S., p. 69, sec. 416; 19 Stat. at L., p. 312)	250	
Five watchmen, at $720 each, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 312)	3,600	
Two laborers, at $720 each, per act March 3, 1877 (R. S., p. 26, sec. 167; 19 Stat. at L., p. 312)	1,440	
	5,290	5,290
CONTINGENT EXPENSES, BUILDING.		
Incidental labor, fuel, light, and miscellaneous items (appropriated,) (19. Stat at L., p. 312)	7,000	5,000
CONTINGENT, NAVY.		
Rent and furniture of buildings and offices not in navy-yards; expenses of courts-martial and courts of inquiry, boards of investigation, examining-boards, with clerks' and witnesses' fees, and traveling expenses and costs; stationery and recording; expenses of purchasing-paymasters' offices at the various cities, including clerks, furniture, fuel, stationery, and incidental expenses; newspapers and advertising; foreign postage; telegraphing, foreign and domestic; copying; mail and express wagons, and livery and express fees, and freight; all books for the use of the Navy; care of library; experts' fees, and costs of suits; commissions, warrants, diplomas, and discharges; relief of vessels in distress, and pilotage; recovery of valuables from shipwrecks; quarantine expenses; care and transportation of the dead; reports, professional investigation, and information from abroad; and all other emergencies and extraordinary expense arising at home or abroad, but impossible to be anticipated or classified, (appropriated) (19 Stat. at L., p. 385, sec. 1)	80,000	80,000
POSTAGE.		
Official postage-stamps for the Secretary's office and the bureaus of the Navy Department, (appropriated) (19 Stat. at L., p. 319)	20,000	20,000

No. 2.—NAVAL ACADEMY.

REPORT OF SUPERINTENDENT.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., November 13, 1877.

SIR: In submitting my annual report, I beg to renew the two recommendations I made last year:

1st. That the system pursued at West Point, of appointing cadets at least one year before they shall present themselves for admission, be adopted at the Naval Academy.

To this I would add the recommendation that, for each Congressional appointment and for each appointment "at large" there shall be, at the same time, appointed an alternate, to be examined in the event of the failure to qualify by the person first appointed.

2d. That Congress be moved to make the necessary appropriation to build an additional wing to the new cadet quarters, so that the cadets may be quartered under one roof, to the great benefit of their discipline, their health, and the economy of the administration of the school. We have now ninety cadet-engineers, and the present cadet quarters are not large enough to lodge all the cadets, with proper consideration for their health and comfort.

In my opinion the number, both of cadet-midshipmen and cadet-engineers, might be advantageously decreased. During the present winter, for the first time, the list of ensigns will be filled, and midshipmen who shall have passed their examination for promotion to that grade must wait for new vacancies before they can reach it. Under our present system, this number of passed midshipmen will increase every year, and we shall have the sorry sight of an ever-increasing number of young gentlemen—two, or perhaps ten, years after their graduation—waiting, with hope long deferred, for promotion for the lowest grade of commissioned officers.

We shall also, under the present system, graduate every year many more cadet-engineers than will supply the waste of that corps. I would therefore respectfully suggest that either the number of cadet appointments be largely decreased, or that a new system be adopted which would produce far better results than the one now in force. I would suggest that some able actuary be found to calculate the annual waste of the Navy, both of the line and of the engineer corps; and further, that he should compute how many cadets should each year enter the second class to supply that waste, and keep the number of officers in the lower commissioned grades of the Navy always full.

This table could be made more easily than the tables of the life-insurance companies, and might be rearranged every five or ten years. The number of cadets for the second class being thus decided, admission to it should be the prize, for which all entering the Naval Academy should compete during the first two years of their novitiate. Those who failed to win the prizes, might graduate at the end of their first two years, and return to their homes with an honorable diploma, and would well repay the country for the cost of their training by carrying to every Congressional district in the land the habit of discipline, the traditions of military life, and a practical knowledge of the use of arms, which would make them invaluable in the organization of volunteer regiments whenever the country found occasion to call its citizens to arms.

There is a subtle power in military discipline which cannot be readily defined, but which gives to those who have learned to obey a great capacity to command with ease and with ready acceptance. Under this system no cadet need be found deficient, except for grave misconduct or for contumacious and inexcusable neglect of study.

All countries are following the example of the United States in raising their standard of naval education; for all the world begins to recognize that a scientific training is highly desirable in those who are to command the ships of war of to day (and of the future), with their new engines of destruction, their complicated machinery, and their novelties of structure. When I entered the Navy, the wooden line-of-battle-ship—a short ship, easily handled under canvass—was the highest type of a fighting vessel. Its guns were weak and of small caliber, having upon them no sights worthy of the name; the powder was poor; flint-locks were used; the whole ordnance equipment was very bad; there were no torpedos; no rifled cannon; no steam-engines; no armor, nor any of those extraordinary provisions of strength such as the foreign iron-clads now exhibit, to enable them to endure the shock of battle and the terrible strain to which their own machinery subjects them when they are driven by it at their greatest speed.

The education given at the Naval Academy lays a foundation upon which the graduates of this school may build the highest professional education. It gives them keys by which they may unlock the mysteries of ship-building and ordnance and gunnery, and all the intricacies involved in the torpedo system, and, at the same time, it trains them to the use of all arms; it exercises their muscles so as to develop the manliest habits, and during four years practical work as "topmen," it teaches them the duty of a private seaman, a training that was not given to the naval youth of my day, and which, to my mind, gives to our graduates a great advantage, by enabling them to sympathize with those whom they are to command, from having themselves performed a private seaman's duty, both aloft and at the guns.

There is, naturally, great complaint now from the disappointed friends of cadets who have been too idle to profit by the opportunities given them here, or, in some rare cases, perhaps, too dull. It is my carefully considered belief that any lad of even a little less than average ability, can complete successfully the course of studies here, if he will study faithfully and diligently. Those of more brilliant capacity can attain the same result with a very moderate amount of study. To take honors at the school requires both capacity and hard work.

The government offers to its young men at the Naval Academy an honorable career, and an excellent education at the countrys' cost, and it demands from them only that they shall not be dull, idle, unfaithful, or vicious.

The professors and officers are uniformly desirous to graduate as large a class as possible; they are ready to give all the assistance in their power, and it is, of course, a matter of anxiety to the academic board to avoid the great concern its members feel when witnessing the disappointment of parents and friends, caused by the failure of those whom they had hoped had secured an honorable calling.

It is sometimes claimed that the course here is too severe, and I venture to give it as my opinion that such is not the case, and I think that if the demands of the course were largely decreased, we should have no more graduates. As the demand decreased, the effort of the student would diminish; for it is now not the love of learning, but the fear of failure, which prompts the majority to exertion, and with the larger number the effort is to do as little instead of as much as possible.

It is sometimes objected that we lay too much stress upon the study of mathematics; that the cadets are not needed as mathematicians but as sea-officers.

I know of no study that will so carefully train the mind to quick, clear thought, and to the ready application of principles, as the study of pure and applied mathematics. The course of mathematics here leads directly to those principles of physics and to the scientific knowledge which have now become essential to the sea-officer, who would fully understand the engines of war committed to his care. He must still be a seaman, but a scientific seaman, and his science and mental training will in no degree abstract from his nautical skill.

I beg to submit a table showing the number of graduates during the administration of the last five superintendents of the Naval Academy, no class having graduated during the administration of the earlier superintendents.

I also append an order directed to the several heads of departments, and their replies thereto.

I have the honor to be, very respectfully, your obedient servant,

C. R. P. RODGERS,
Rear-Admiral, Superintendent.

HON. R. W. THOMPSON,
Secretary of the Navy, Navy Department, Washington, D. C.

The following table shows the number of graduates during the administration of each of the last five superintendents of the Naval Academy.

Superintendents.	Number of classes.	Number of graduates.	Number admitted in the same classes.	Per cent. of graduates.
Admiral Goldsborough	3	52	134	39
Commodore Blake	8	272	718	38
Admiral Porter	4	315	666	47
Rear-Admiral Worden	5	200	434	46
Rear-Admiral Rodgers	3	117	252	46
Total	23	956	2,204	43.4

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., November 14, 1877.

[Order No. 139.]

Heads of departments will present, as soon as possible, a clear, brief, and succinct statement of the professional importance of the studies under their charge in the academic course, showing exactly why they are necessary or useful to future naval officers in the duties of their profession, or as an indispensable preparation for higher branches.

C. R. P. RODGERS,
Rear-Admiral, Superintendent.

REPORT OF BOARD OF VISITORS.

UNITED STATES NAVAL ACADEMY,
June 20, 1877.

SIR: The board of visitors appointed to attend the annual examination at the United States Naval Academy, at Annapolis, Md., have the honor to submit the following report of their proceedings:

The board assembled on the morning of the 11th instant, all the members being present. An organization was effected by the election of Commodore J. W. A. Nicholson, United States Navy, as president; Brig. Gen. W. H. Emory, United States Army, as vice president; and Master H. O. Rittenhouse, United States Navy, as secretary.

Committees were appointed to whom were assigned the various subjects coming before the board for examination, and during the ten days the board was in session daily meetings were held.

We take great pleasure in expressing our general satisfaction with the Academy and its administration, and in acknowledging the readiness with which every facility has been accorded us by the superintendent, Rear-Admiral C. R. P. Rodgers, and his assistants in all the departments, for a full examination of everything pertaining to the institution and its management. In our investigations we have found scarcely anything to criticise and nothing to censure. The discipline observed is, in our opinion, all that can be desired, being strict and exacting, yet administered with uniform kindness and regard to the welfare and sensibilities of the cadets.

We deem it but due to the corps of instructors at the Academy to refer in terms of high commendation to the thoroughness with which they perform their work and the excellence of their methods of instruction. The plan of frequent examinations, generally written, during the academic year, has advantages over the oral method so obvious as scarcely to need enumeration. The facts and principles learned are thus more deeply impressed, and the habit of facile and accurate expression of thought acquired in connection with each branch taught. This method imposes an immense amount of labor on the instructors, and can only be fully carried out in institutions in which the heads of departments are aided in their work by a number of subordinates proportionate to the number taught.

APPOINTMENT OF CADETS.

We repeat the recommendation contained in previous reports, that cadets should be appointed a year in advance, as at West Point, with an alternate, also a year in advance, so that he may not be found unprepared if the first should fail to pass the examination for admission.

APPOINTMENT OF INSTRUCTORS.

We cordially indorse the recommendation of Rear-Admiral Rodgers, the superintendent, that to secure and retain the best ability for this institution, professors should be appointed to the several departments, as at the West Point Military Academy, with the rank and emoluments of commander, and after ten years' service with the rank and emoluments of captain in the Navy.

GROUNDS, BUILDINGS, AND SANITARY CONDITION.

We have to commend the excellent order of all portions of the establishment. The grounds could hardly be more beautiful. The residences are comfortable; the general sanitary condition excellent; but we consider the following changes and improvements, most of which have been recommended by former boards, as essential to the growth and prosperity of the Academy.

We urge the erection of another building for the cadets connected with or near the present cadets' quarters, and the removal into a separate building, or to the upper story of the present new building, of the kitchen, laundry, and store-rooms, now occupying the basement of the cadets' quarters.

We highly commend the suggestions made by the superintendent in his report to the Navy Department, and those contained in the late very complete sanitary report of Medical Inspector A. L. Gihon, and especially advise that immediate steps be taken to acquire the premises comprised in the small triangle lying between Hanover street and the government property on Grave-Yard Creek, with the removal of the gas-works, the slaughter-house, and the objectionable neighborhood of filthy shanties and cabins, with the surface drainage incident to such localities.

A new armory, drill-room, and gymnasium are of imperative necessity, and we strongly recommend their establishment.

The erection of suitable quarters for the marine-guard, and their transfer from the objectionable location on board the Wyandank, is recommended in this connection.

The addition of another story to the rear wing of the sick-quarters for cadets in the Academy grounds is recommended, which will complete the accommodations of this excellent department at a very small expense.

The recent outbreak of an epidemic of measles in the Academy has demonstrated the necessity of a hospital outside the inclosed grounds of the Academy to which such cases of sickness may be transferred. The building on the government farm answers every requirement of the station, and can be maintained at a small expense. We recommend that a sufficient appropriation be made therefor.

The necessities of the department of steam-engineering require a small addition to the present building. We are of the opinion that the wants of this important department should be liberally supplied, and this will require only a slight expense without material alteration of plan or appearance.

We have to repeat the recommendation made by former boards, of new and proper accommodations for the department of physics and chemistry.

THE COMMISSARIAT.

The commissariat of the Academy is just at this time in a transition state, having been for the past twenty-six years and until quite recently under the administration of Colonel Swann, a civilian of good business capacity, who, in addition to providing for the cadets, kept a market of provisions and groceries for the convenience of officers' families, with great acceptance. Upon the recent sudden death of Colonel Swann it was deemed best by the authorities of the Academy, having in view the experience at the Military Academy at West Point in this respect, that the commissariat should hereafter be in charge of a commissioned officer who should confine his duties simply to the proper subsistence of the cadets and be militarily responsible for the efficiency and economy of his administration. Paymaster A. S. Kenny, of the Navy, was on the 7th ultimo selected and assigned by the Navy Department to this duty. The introduction of a new system being so recent, all details have not yet been fully worked out; but, so far as investigated by the board, it is marked with ability and judgment, the provisions furnished being of unexceptionable quality, the allowance liberal and well prepared, and served in an attractive manner.

SEAMANSHIP, GUNNERY, AND NAVIGATION.

In the departments of seamanship, gunnery, and navigation we found a high state of efficiency. We believe the course in these studies to be as complete as it can be, considering the time necessarily taken up by the other branches. It is recommended that two suitable brigs of light draught be obtained, in order that the cadet-midshipmen may be more thoroughly exercised in the seamanship branch of their profession. It is suggested that these brigs be permanently stationed at the Naval Academy, and that they supply the place of the Dale, now moored at the wharf. The advantage of this change would be that the cadets would thus be enabled to see at once the effect of all evolutions in a vessel under way, which they cannot do in a vessel moored at the wharf.

CADET-ENGINEERS.

Owing to the great advance in and growing importance of the science of steam-engineering and naval architecture, the board are of the opinion that an advanced course of instruction, both theoretical and practical, is desirable for the cadet-engineers. After a most careful investigation into the present admirable course on these subjects instituted by the Superintendent, we are forced to the conclusion that it would be impossible to add any more to the same without detriment to the other branches necessarily required in the time given for instruction at the Academy.

As at the present time there are no schools or prominent building establishments in the United States where, by observation and study, a theoretical and practical knowledge of their profession can be acquired, such as would be necessary to enable the young engineer to arrive at eminence in all branches of his profession, we feel that we cannot too earnestly recommend that four or five of those cadet-engineers who shall have achieved a prominence in their academic course shall be given one or two years (as the Navy Department may elect) in the schools and establishments of engineering and naval architecture of Great Britain, where, in our opinion, are to be found the best establishments of that kind.

We would also recommend that a post-graduate course should be given to the midshipmen and cadet-engineers not specified above, which should be one that their duties, and distractions incident to a life on board ship, shall not prevent the cadets complying fully with all of its requirements. This course should be arranged in detail by the Superintendent and his able corps of assistants.

ENGLISH STUDIES AND MODERN LANGUAGES.

We have been much pleased with the general course of English studies, and are satisfied with the care of the teachers and the diligence and progress of the cadets in the oral examinations in the French language; the proficiency of the cadets, where so little time can be devoted to this branch of study, exceeded our expectations. We must, however, state our conviction that the time allowed to modern languages is not sufficient for a thorough study of two even so nearly related as French and Spanish; at the same time we do not see how the time could be enlarged without taking it from other branches of equal importance. We would therefore suggest that the academic board be requested to consider whether a different distribution of time in the study of French and Spanish can be made, so that one of those languages shall be studied more thoroughly in the Academy, and the other be constituted a part of the post-graduate course.

THE LIBRARY.

The arrangement of the books in the library and the regulations for their use seem to be all that can be desired. There are now 19,000 volumes of valuable and well-selected works in the collection, and we earnestly recommend a liberal appropriation to be made annually by Congress for its gradual increase.

Besides the general collection of such books as are required in the library of every institution of learning of the first class, the library of the Naval Academy should have the means of making a complete collection of voyages and travels, and works on geography and the exploration of the earth's surface. This may well be made its specialty, as no other large library has the same reasons for making its collection of such works complete; and one such collection, where everything on the subject may be found, will be of benefit to the whole country.

The room now appropriated for the purpose seems quite insufficient for the proper accommodation of the library, and at no distant time other arrangements will have to be made. In view of this necessity we also recommend that provision for a fire-proof building, or extension of the present one, should be immediately considered and provided for. The collection is too valuable to be risked in an ordinary building.

In the library is a small collection of portraits of the former heroes of our Navy, and the board think it highly desirable that this should be increased, thus gradually forming a national collection of the portraits of those men whose names have always been "familiar in our mouths as household words." There are many such portraits in the possession of private families, scattered throughout the country, which (or copies of them) might well be given to this collection, thus insuring their preservation in a national institution, where the coming men of the Navy may gather from their view the true spirit of their profession. Perhaps we may properly add that, in addition to portraits, this might be made a museum for historical pictures and relics of the Navy with great benefit to the cadets, and we therefore recommend the consideration of the subject.

In conclusion, and as the result of our examinations, we consider it our duty to strongly commend this important and interesting branch of the public service to you, and through you to the nation, as deserving of the most liberal support.

All of which is respectfully submitted.

J. W. A. NICHOLSON,
Commodore, U. S. Navy, President of Board.
W. H. EMORY,
Brigadier-General U. S. A., Vice-President of Board.
R. P. BUCKLAND, *Ohio.*
W. I. KIPP, D. D., LL.D.,
Bishop of California.
W. G. HAMMOND,
Iowa State University.
J. F. QUINBY, *New York.*
S. R. FRANKLIN,
Captain, United States Navy.
J. C. ELDREDGE,
Pay Director, United States Navy.
S. C. HOUK, *Tennessee.*
J. A. LEONARD, *Minnesota.*
J. P. SPRAGUE,
Chief Engineer, United States Navy.
F. M. GUNNELL,
Medical Director, United States Navy.
C. A. CURTIS, *Massachusetts.*

The honorable the SECRETARY OF THE NAVY.

REPORTS OF CRUISE OF PRACTICE-SHIPS.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., November 21, 1877.

SIR: I beg to submit the report of Commander Terry, commanding the practice-ship Constellation, having the cadet-midshipmen on board, and the report of Commander Sampson, commanding the practice-steamer Mayflower, having on board the cadet-engineers, during the practice-cruises in the past summer.

I am, very respectfully, your obedient servant,

C. R. P. RODGERS,
Rear-Admiral, Superintendent.

HON. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., September 25, 1877.

SIR: In obedience to your order of June 16, 1877, I have the honor to submit the following report of the practice-cruise of the Constellation during the past summer.

On the 22d day of June, thirty-six cadet-midshipmen of the first class and fifty-seven of the third class were embarked, and on the 26th day of the same month we left Annapolis Roads. July 2 we arrived off New Bedford, and from that date until July 20, the ship remained in Buzzard's Bay, busily employed exercising.

As soon as the dock at New York was ready to receive her, she proceeded there to repair damages sustained by grounding last summer and this.

Returning to Buzzard's Bay, after less than a week at New York, the exercises were continued until August 24, when we visited Newport for a week. From there we returned to the Chesapeake, disembarking the cadets at Annapolis, September 18.

The organization, the general character of the cruise, and the methods and extent of instructions were almost identical with those of the two preceding years.

I would respectfully call your attention to the amount of practical work accomplished by both classes under the system employed during the last three years. I have had some experience in former methods, both as a midshipman and as executive officer, and I know that in those cruises the opportunities afforded the cadets for practical work were comparatively few.

In Buzzard's Bay, by anchoring at night and getting under way in the morning, the ship's company was afforded ample time for rest, and the result was a cheerful and ready obedience during the day, although a constant demand for heavy work was caused by the character of our exercises.

Aside from the general work of making and taking in sail, reefing, sending up and down light yards, bending and unbending sails, &c., the cadets of the first class, during the last three summers, have performed, in charge of the deck, more than one thousand maneuvers, including tacking, wearing, box-hauling, chapelling, getting under way, and anchoring.

The great amount of seamanship drill at the Academy renders heavy spar exercises during the practice-cruise unnecessary, and consequently no attention is paid to them.

I inclose, in duplicate, the reports of the two classes who were on board.

I am, sir, very respectfully, your obedient servant,

EDWARD TERRY,
Commander, Commandant of Cadets.

Rear-Admiral C. R. P. RODGERS,
Superintendent Naval Academy, Annapolis, Md.

UNITED STATES STEAMER MAYFLOWER,
UNITED STATES NAVAL ACADEMY,
Annapolis, Md., September 20, 1877.

ADMIRAL: In obedience to your order of June 16, I have the honor to submit the following report of the practice-cruise of this ship with the two classes of cadet-engineers embarked on board. The first class numbered fifteen (15) and the third class twenty-two (22) members. Passed Assistant Engineers L. W. Robinson and C. W. Rae were ordered from the Academy as instructors to the cadets during the cruise.

The cadets were watched, stationed, and all their mess arrangements completed before they came on board. Both classes were embarked on the 21st of June, and the Mayflower sailed from Annapolis on the 26th. The general plan of instruction has been similar to that of previous cruises.

Some modifications have been found necessary, however, as this is the first cruise during which two classes have been under instruction. The first class, having studied their profession at the Academy, and having made one practice-cruise before, required much more advanced instruction than the members of the third class. It was found impracticable for this reason to instruct both classes at the same time; and as the classes are quite large, each one required the whole attention of both instructors whenever they visited a place for instruction.

The plan followed has been for both instructors to take the classes on shore, on alternate days, adapting the instruction to the class in hand. The members of the first class have been required to give their attention to special machinery and mechanical drawings of improved machinery, such as could be obtained in the draughting-rooms of the establishment visited.

The third class have been required to sketch and explain machine-tools.

As on previous cruises, the cadets of both classes have been required to make sketches and take notes upon the spot. The sketches have afterward been developed into more careful drawings in their sketch-books, and the notes carefully written out in their journals. These journals have been read and corrected by the instructors after each day's work. The sketch-books have been examined weekly by the instructors. Both journals and sketch-books have been examined at intervals by the commanding officer.

June 29.—Reached Wilmington, Del., where we were kindly furnished wharfage at the ship-yard of Messrs. Harlan & Hollingsworth. While there the cadets visited the works of the Diamond State Iron Company, Seidall & Hastings's Plate-Rolling Mills, and Harlan & Hollingsworth's. While at Wilmington a short leave was granted to ten of the cadets.

July 3.—Left Wilmington and reached Chester, Pa., the same day.

At the latter place the cadets visited the extensive ship-yard and machine-shops of Messrs. Roach & Sons.

July 7.—Left Chester and reached Philadelphia the same day, where the Reading Railroad Company placed a wharf at our disposal. While in Philadelphia the cadets visited the Tasker Iron-Works, Baldwin Locomotive Works, the works of William Sellers & Co., works of George V. Cresson & Co., and the International Exhibition; also the ship-yards of Messrs. Neafie & Levy, and William Cramp & Sons. Through the kindness of the latter firm, builders of the fine steamships of the American Steamship Company, the cadets were invited to take passage in the large steamer Pennsylvania down the river and bay to the capes. Accordingly the cadets were sent on board the Pennsylvania early on the morning of July 19, the Mayflower preceding the Pennsylvania down the river. When the steamship Pennsylvania had overtaken the Mayflower, near the Delaware capes, the cadets were received on board and the vessel proceeded to New York.

While at Philadelphia the cadets who had been granted leave at Wilmington rejoined the ship, and another party of nine were given the same privilege and ordered to rejoin the ship at New York.

July 20.—Reached Brooklyn navy-yard. At New York the cadets visited the Morgan Iron-Works, Delamater Iron-Works, Brooklyn Water-Works, Worthington Steam Pump Works, Brooklyn Hydraulic Works, and the works of Merrill & Sons.

At the navy-yard the cadets visited the draughting-rooms, machine-shops, and vessels. The party given leave in Philadelphia rejoined the ship, and another party of nine were granted leave, to report at Newport, R. I.

August 4.—Left the navy-yard and anchored the same day off Cold Spring, on the Hudson, where the cadets visited the foundery.

August 7.—Steamed over to Newburg, where the cadets visited the Greenwood Furnaces. During the 9th and 10th a short visit was paid to West Point.

August 10.—Returned to New York, and sailed from there the following day for Newport.

August 12.—Reached Newport, where the cadets on leave rejoined the ship; and the remaining nine were given leave, to rejoin the ship on her return to New York.

August 14.—Got under way from Newport, and the same day, in company with the flag-ship Constellation, anchored at Oak Bluffs, where the cadets were given leave to visit the shore for the remainder of the day.

August 15.—Got under way from Oak Bluffs, and the same day anchored at New Bedford. At this place the cadets visited the New Bedford Copper-Works and the works of the Morse Twist-Drill Company. The manufacture of the Morse twist-drill is to a certain extent a secret process, but the cadets were kindly explained the entire process, and the works of the company will doubtless in future be open to the inspection of the cadets on the cruise. The special machinery used in the works is highly interesting and instructive.

August 17.—Left New Bedford, and the same evening reached Newport. At the torpedo-station the cadets of the first class, whose previous studies at the Academy had prepared them to understand what they saw, had an opportunity of witnessing the manufacture of nitro-glycerine; also of examining the different forms of electric machines in operation at the station, and seeing the manufacture of the fuses and various torpedoes.

August 22.—Left Newport for Providence, where the cadets inspected the Hope Station pumping-engines, Providence Tool Company's Works, the works of the American Screw Company, the Providence Steam-Engine Company, and the Corliss Steam-Engine Works.

August 28.—Sailed from Providence, and reached New York the following day. Received on board the party of cadets who had been on leave. Coaled ship, and sailed for Washington on September 1.

September 2.—While off the capes of the Delaware, one boiler became disabled through defective tubes. The remainder of the passage to Norfolk was made under one boiler. As I was obliged to stop at Norfolk for repair, advantage was taken of the delay to have the cadets visit the machine-shops, draughting-rooms, and many of the vessels lying at the yard.

The repairs to the boilers requiring more time than was at first anticipated, you ordered that instead of going to Washington the ship come directly to this place, where she arrived September 11.

In conclusion, I have to report that the conduct of the cadets during the cruise, with two or three exceptions, has been very good.

The inclosed report of professional aptitude, attention to duty, deportment, &c., contains these points in detail.

The officers, without exception, have been zealous and efficient in the performance of their duties.

At all the establishments visited, the cadets have been received with uniform kindness, and every facility for their instruction placed at their disposal. In many cases their visit was anticipated, and special machinery set in motion, or interesting processes exhibited which they might not otherwise have understood.

I respectfully recommend that the visit to Wilmington, in future cruises, be omitted. The creek in which the ship must anchor is bordered by an extensive marsh, and at low water a large extent of the bed of the creek is exposed.

Respectfully submitted.

W. T. SAMPSON,
Commander, Commanding Mayflower.

Rear-Admiral C. R. P. RODGERS, U. S. N.,
Superintendent Naval Academy.

REPORT OF HEAD OF DEPARTMENT OF NAVIGATION.

UNITED STATES NAVAL ACADEMY,
DEPARTMENT ASTRONOMY, NAVIGATION, AND SURVEYING,
November 15, 1877.

SIR: Understanding order No. 139 to refer more particularly to the theoretical course in this department, I have in what follows confined myself to stating a plea for theory.

Our course in astronomy prepares the cadet for the consideration of problems in navigation; also for practice with those astronomical instruments which he may be called on to use if attached to the Coast Survey or to an expedition similar to the one on which the Guard is now engaged.

The course in navigation and surveying prepares the cadet to navigate a ship and survey a harbor. It is simply an application of his knowledge gained in the mathematical departments; to the solution of problems in navigation and surveying; to the mathematical investigation of the deviation of the compass, as presented either in British admiralty publications or those of our own Bureau of Navigation; to the comprehensive consideration of the charts used in the United States Navy or Coast Survey, and to the intelligent use of such books as "Projection Tables, United States Navy," issued by Bureau of Navigation, 1868. Besides thus enabling him to understand very important branches of his profession, to read intelligently the numerous articles or books constantly appearing, which treat of navigation, on which an officer should be able to express a sensible opinion, the theoretical course is of the greatest value in preparing for the facility of operation and exactness of result, which is the final test of the navigator; for given the question of preparing a lad to be an excellent navigator in six years.

I believe the best authorities will agree with me to devote a portion of the period to the theory of navigation, and the remainder to the practice.

In our course we supplement theory with sufficient practice to illustrate the theory and to give certain facility in the use of instruments, but the principal practice should follow graduation, as it is only at sea that an experienced navigator can be made.

In conclusion, I claim that when the system fails, such failure is nearly always due to the fact that the graduate has neglected the practice of navigation after leaving the school.

Very respectfully,

J. A. HOWELL,
Commander, U. S. N., Head of Department.

Rear-Admiral C. R. P. RODGERS, U. S. N.,
Superintendent.

REPORT OF HEAD OF DEPARTMENT OF SEAMANSHIP.

UNITED STATES NAVAL ACADEMY,
DEPARTMENT OF SEAMANSHIP, &C.,
November 19, 1877.

ADMIRAL: Complying with your order of the 14th instant, I respectfully report the following as the course of instruction pursued in this department, and a statement of the professional importance of these studies:

During the first two years at the Academy the cadet-midshipmen make a practise-cruise of three months' duration, when they perform the duties of an enlisted man; they also perform the same duties at seamanship drill two or three times a week during the academic year, when the weather will permit. In the third year they are taught elementary seamanship, with the assistance of the practical drills, models, text-books, and lectures, and are prepared to exercise the duties of officer of the deck, petty officers, and seamen, upon their practice-cruise during the following summer, when they are carefully and patiently instructed as to the reasons and necessities of complying with the directions, as are considered the best, for the management and care of vessels.

They are also taught naval tactics during their third year, and this instruction is enforced by frequent drills with a fleet of cutters, fitted for that purpose.

During the fourth year the first class is instructed in the principles of handling a ship under all circumstances, and in preparing for and being able to properly meet the emergencies of a sea-life.

A short course is given in naval construction, for which the previous training in the mathematical department is essential to readily understand the calculations and formulas necessarily used in this important branch of study.

Attached to this department is an instructor in swimming, gymnastics, and boxing. Immediately after the cadets enter they are taught to swim; the following year they receive instructions in gymnastics, and during the remaining two years they are given frequent lessons in boxing.

The manner of signaling under all circumstances, with all kinds of contrivances, is thoroughly taught, and this is one of the several professional drills under the charge of this department.

To the naval officer, seamanship is the inherent adjunct of his profession. Its importance cannot be doubted in the course of instruction at a naval institution. It is carefully taught here, theoretically and practically, with the aim that when a cadet leaves the Academy he shall be a good "topman;" know how to heave the lead and steer; and shall have as thorough knowledge of the duties required of a naval officer as a graduate of any college has of the requirements of the profession he has been fitting himself to enter. It is only necessary for the cadet-midshipman to have, for a short time, the opportunity to practice that which he has been taught, to make him a competent officer.

It is unreasonable to expect a graduate to at once perform everything in his profession as well as those duties are discharged by men who have been years at this work. The young aspirant for the honors of the medical or legal professions may have graduated with high distinction, but he will find it difficult to persuade men to trust him with any case of importance until he has had some years of experience in actual practice. His distinguished honors at graduation amount to but little unless he continues his studious habits. He must be allowed some little time to develop and to apply his knowledge before he is judged as to his fitness to take rank with even the younger members of his corps.

Seamanship, at the Academy, is considered of paramount importance, and it is believed by those familiar with the course of instruction in this branch of study here that never, in our ships of war in active service, has the same amount of instruction been given to naval youth.

A person should know something of the strength and condition of his domicile, particularly when that habitation is a floating structure, tossed, strained, and knocked about by the violent winds and heavy seas which are to be met with at any time during the cruises of sea-going vessels.

The study of naval construction gives this important professional knowledge, and had it been more thoroughly understood, serious accidents with new vessels, where many lives have been lost, would have been avoided, and large sums of money saved, by constructing ships properly which have proved to be worthless by reason of not conforming to the easy rules and laws of naval architecture.

I am, sir, very respectfully, your obedient servant,

H. L. HOWISON,
Commander, U. S. N., Head of Department.

Rear-Admiral C. R. P. RODGERS, U. S. N.,
Superintendent.

REPORT OF HEAD OF DEPARTMENT OF ORDNANCE.

NAVAL ACADEMY, DEPARTMENT OF ORDNANCE, &c.,
November 16, 1877.

SIR: I have to acknowledge the receipt of order 139, and reply as follows:

Cadet-midshipmen come under instruction in the department of gunnery during the last two years of their course at the Academy in those classes which are called second and first.

Cadets of the second class are instructed in infantry and light artillery tactics, and in the naval-ordnance instructions.

It frequently becomes necessary to land seamen for service ashore, not only in war, but in peace also, owing to the unsettled condition of many countries visited by naval vessels. Our ships are supplied for such service both with infantry-equipments and light field-pieces. A knowledge of tactics, up to and including the handling of a battalion, is therefore a matter of practical necessity.

The ordnance-instruction book contains descriptions of the different guns, carriages, &c., in use in the Navy at the date of its publication, with the methods of handling and drilling the same; equipment of boats for every kind of military service on which they may be employed; magazine arrangements, and details of the construction and use of ordnance materials and implements.

Having been thus taught the merely practical part of this branch of their profession, with great part of which the men under their control will be as familiar as themselves, the following "first-class" year is given to teaching the mode and principles of making the various weapons, projectiles, and explosives with which they will have to deal. Beginning with the manufacture of gun-metals from the ore, the course embraces such subjects as casting, building, and inspecting guns; various systems of rifling; gun-carriages of many patterns; manufacture and testing of gunpowder; sighting guns; pointing in theory and practice, &c.

While the greater part of the text-book is devoted to our own system and methods, there is also mention, and in some cases description, of the inventions and methods of other nations. This is desirable in all countries, now that a general race is running in the enlargement of ordnance, improvement of methods, and invention of new appliances. It is the more necessary in our country because the United States, for economical reasons, has not engaged in this race.

There can, I think, be no question of the professional importance to naval officers of the instruction mentioned above.

Very respectfully,

A. T. MAHAN,
Commander, Head of Department of Gunnery.

Rear-Admiral C. R. P. RODGERS,
Superintendent Naval Academy.

REPORT OF HEAD OF DEPARTMENT OF PHYSICS, ETC.

NAVAL ACADEMY,
DEPARTMENT OF PHYSICS AND CHEMISTRY,
November 14, 1877.

ADMIRAL: In complying with your order No. 139, I have to remark—

1st. That the importance of any study to a naval officer depends upon the recognized need of the knowledge acquired by such study.

As there is a great diversity of opinion in the service as to what should constitute the acquirements of an officer, the reasons for pursuing a study which might be convincing to one might have no weight with another.

2d. All should accede to the general principle, that the more comprehensive and thorough an officer's education, the better is he fitted to perform his duties.

3d. Every branch of a naval officer's profession furnishes many illustrations of the application of science, and an officer will better comprehend the applications when he understands the scientific principles upon which they are based. It may not be absolutely necessary that an officer should understand the chemical and physical difference between the materials used in a cast-iron, wrought-iron, or steel gun; yet, I think, there can be no question that such knowledge will be serviceable many times.

4th. No academic course of study can possibly meet all the special cases which may arise during a professional career, and that course of study best attains its proper end which best fits the student to grapple with special cases as they arise. The testimony of those who have devoted their lives to educational affairs is that the easiest and quickest way to prepare a young man for a profession is to commence with a careful general training. It may at first seem indirect, yet the early culture insures rapid progress in the profession and its thorough mastery when commenced.

5th. While the Naval Academy is a technical school, it must not be overlooked that its students depend upon it for their mental training as well as their technical education.

Hence, the objects of the course in this department are to develop the cadet's powers of observation, and make him prompt and correct in interpreting the impression of his senses. As a student's interest in a study is increased when he comprehends that the knowledge acquired is to be put to actual use, every occasion is made use of to draw his attention to the bearing of his study upon his profession. Problems for illustration are selected with a special view to similar ones he will meet in practice.

In this way he is taught the theory, construction, and use of instruments he is required to use in his profession; as the thermometer, barometer, hygrometer, hydrometer, &c. He is taught the laws of flotation and conditions of equilibrium of floating bodies. He is taught the general principles of wave motion, as applicable to the propagation of sound and light. He is taught the theory and construction of the optical instruments he will be called upon to use; as the telescope, sextant, &c.

In electricity he is taught the theory and application of this agent to its various uses in the service, which are daily becoming more numerous. He is taught the theory of the construction of the compass, and the various sources of compass-error which exist in all ships, and especially in those made of iron or iron-clad.

In heat he is taught the theory of the pressure of gases and vapors, the theory of heat-engines, including the steam-engine, and the possible amount of energy that may be converted into useful work in the steam-engine.

In chemistry he is taught the philosophy of the science, together with the chemistry of common things; also, the chemistry of the manufacture of iron and steel, of gunpowder, gun-cotton, nitro-glycerine, dynamite, &c., and the various fulminates. Throughout the course the grand principle of the conservation of energy is constantly held up as a check and guide. The metric or decimal system is principally used, to the end that the future officers may be prepared to readily take up any points of professional interest in foreign countries and communicate with facility with foreign officers and men of science.

The attainments required of a naval officer of the present day may be inferred from the character of the articles published in such periodicals as the Engineering, the Proceeding of the Royal United Service Institution, Proceedings of the Institution of Naval Architects, &c., many of which articles require, for a fair understanding of them, scientific knowledge of no mean character. The means of attack and defense in naval warfare are constantly becoming more and more complicated, and naval officers have, in the same proportion, more to learn to master their profession. He should be prepared by scientific training to adapt himself to the great and rapid changes that are liable at any moment to arise in his profession. If a naval engagement were to take place to-day between two modern fleets, the result might entirely revolutionize our ideas of naval warfare.

He who would be most prompt to appreciate the new condition of things, and adapt himself thereto, will be the best officer. Now, I think this readiness for the future is only to be secured by arming the graduates of this institution at all points by such scientific training as will best prepare them for any contingency.

Very respectfully,

W. T. SAMPSON,
Commander, Head of Department.

Rear-Admiral C. R. P. RODGERS, U. S. N.,
Superintendent United States Naval Academy.

REPORT OF HEAD OF DEPARTMENT OF STEAM-ENGINEERING.

NAVAL ACADEMY,
Annapolis, Md., November 20, 1877.

SIR: In obedience to your order No. 139, dated November 14, 1877, I have the honor to submit the following statement of the professional importance of the studies pursued in the department under my charge.

These studies relate to the designing, construction, management, and care of steam-engines and other machinery used in the naval service, and I conceive their importance to be commensurate with the importance of the part now performed by steam-engines in commerce and war.

So far as the studies relate to the *theory* of the steam-engine and of machines in general, they are necessary, because no adequate practical acquaintance with the subject can be had without them. And the theoretical studies are altogether ancillary to the practical instruction given the cadets. The practical instruction received by the cadet-midshipmen will be necessary to them in their future career in the Navy as commanding officers of ships provided with means of offense and defense, not the least of which is the motive-power, which failing, other means must likewise fail in consequence. That he who is to have absolute control of this power should have a good knowledge of the arts by which it is developed seems indisputable.

In the course of instruction of cadet-engineers in my department, by far the greatest part of the time is given to those arts upon which the practice of steam-engineering depends, and nothing is taught that is not absolutely necessary in these times to success in any of the branches of taught are theoretical and applied mechanics, and the differential and integral calculus; the cadet-engineers have also a course in "the strength of materials."

Experience has shown that the present required course of study in this department, while sufficiently extensive to be of great service to the cadets, is not too difficult for any industrious student who has completed the required mathematical course for the third and fourth classes.

There is at present an elective course in the integral calculus and in analytical mechanics, supplementary to the elective course in the department of mathematics.

The time spent at this Academy by the cadets does not permit the introduction of studies whose sole object is the discipline and cultivation of the intellectual powers, however desirable this may be. It seems, therefore, proper that the reasons for the presence in the academic course of certain branches of study should be assigned.

The applications of mechanics are so numerous and important in connection with the naval officer's profession that few will question the utility of this branch, which constitutes the medium through which the practical applications of mathematics are mostly made.

Experience, both here and elsewhere, has shown that the shortest, easiest, and only satisfactory road to this branch of study is through the calculus, since the extra labor involved in comprehending the cumbersome methods adopted in attempting to avoid the use of the calculus fully suffices for the acquirement of a fair knowledge of this subject.

Many important mechanical problems are, however, so dependent upon the calculus that without it they cannot be mastered at all. For example, determining the centers of gravity and moments of inertia of many regular solids; the theory of the strength of beams; the motion of projectiles in air; also many problems relating to hydrostatics, astronomy, and navigation.

It is of the utmost importance that at least a portion of the officers of the United States Navy shall be qualified to keep themselves fully informed as to the professional papers published abroad. As an illustration of the absolute necessity of a knowledge of the calculus for this purpose, it is sufficient to remark that the number of Naval Science (a quarterly published in London) for January, 1875, contains thirteen articles on strictly professional subjects; of these four are beyond the comprehension of a person not familiar with the calculus. The number of the same journal for July, 1874, contains nine articles, of which five involve the calculus. Other examples might easily be cited.

I am, sir, very respectfully, your obedient servant,

J. M. RICE,
Professor of Mathematics, U. S. N.,
Head of Dept. Mechanics, &c.

Rear-Admiral C. R. P. RODGERS, U. S. N.,
Superintendent Naval Academy.

REPORT OF HEAD OF DEPARTMENT OF ENGLISH STUDIES, ETC.

UNITED STATES NAVAL ACADEMY,
DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW,
November 16, 1877.

SIR: Of the subjects taught in the department of English studies, history, and law, the course in English studies includes as much of the elementary branches as is necessary to supply the great defects in the early training of cadets. Beyond this, students become familiar with the rules for composition, and have practical work in writing official reports and papers on designated subjects. This training, important as it is for all men in official positions, is peculiarly so for naval officers, whose official communications are stamped with a permanent character and become a part of the archives of the government. The composition of reports and dispatches demands accuracy, clearness, and facility of expression, which, except in rare instances, can only be acquired by careful training.

The course in history comprises a brief sketch of general European history, a more detailed study of the history and constitution of the United States, and a special course in naval history. The first is necessary to enable officers to understand the relations of the governments whose officers and representatives they meet, and to maintain relations with such foreign officials on an equal footing of intelligent and enlightened intercourse. With regard to the second, it is obviously essential that those destined to occupy a high official position should be acquainted with the character and organization of the government they serve; and he could hardly be considered an accomplished officer who was not well versed in the history and institutions of his own country. The third branch of the subject, which comprises the history of the naval service, with its record of great achievements in the past, is a stimulus to renewed effort in the future. It gathers together and gives permanent form to the traditions of the service, and presents a series of bright examples of professional worth and devotion to duty to be followed and emulated by succeeding generations of officers.

A knowledge of the rules of international law is absolutely necessary to naval officers. Cases frequently arise, in peace as well as in war, where an officer is called upon to make a direct and immediate application of some of these rules, and where his action may be of great moment. Ignorance of this subject may lead to mistakes involving most serious consequences, so serious even as to lead to an unexpected and disastrous war.

Every precaution should be taken to prevent the possibility of such mistakes, and this can only be accomplished with certainty by systematic preliminary instruction in the subject.

Very respectfully,

J. R. SOLEY,
Professor, U. S. N., Head of Department.

Rear-Admiral C. R. P. RODGERS, *U. S. N*,
Superintendent United States Naval Academy.

REPORT OF HEAD OF DEPARTMENT OF MODERN LANGUAGES.

UNITED STATES NAVAL ACADEMY,
DEPARTMENT OF MODERN LANGUAGES,
November 16, 1877.

SIR: In obedience to Order 139, I respectfully submit for your consideration a statement of my views as to the importance of the studies under my charge.

As an agent of the government, the naval officer, more than any other, must have an excellent knowledge of French, not merely because it is an accomplishment, but because it is becoming daily more indispensable to him.

It is the acknowledged diplomatic language of Europe. It is also very extensively used in commercial, scientific, and literary intercourse. There are many books most valuable to the naval officer in the study of his profession that are closed to him unless he be proficient in that language, because many French works are not *translated*, and important publications of other countries of the European continent are translated in the French only. As to the Spanish, the United States has near it many Spanish-speaking countries, Mexico, Cuba, and the South American republics, and it is very important that our naval officers, who are often called to act promptly upon these coasts, should understand and speak the language of those countries.

Very respectfully, your obedient servant,

L. F. PRUD'HOMME,
Professor, Head of Department.

Rear-Admiral C. R. P. RODGERS,
Superintendent United States Naval Academy.

REPORT OF HEAD OF DEPARTMENT OF DRAWING.

UNITED STATES NAVAL ACADEMY,
Annapolis, Md., November 15, 1877.

SIR: I have the honor to acknowledge your order No. 139, under date of November 14, in which you direct that heads of departments shall, as soon as possible, present a statement setting forth the professional importance of the studies under their charge to naval officers.

As head of the department of drawing, having under my direction the teaching of cadet-midshipmen in practical perspective, free-hand drawing from objects immediately connected with the duties of naval officers, as guns with their carriages, hulls of ships, knots, rigging, timbering, &c., and having also under my charge the teaching of topographical and chart drawing, I beg leave to state that drawing, as taught at the United States Naval Academy, is of immediate importance to cadet-midshipmen while in the school, inasmuch as it materially assists them in the acquisition of knowledge in the professional branches, seamanship and gunnery. The course in topographical and chart drawing is of practical importance to the naval officer in fitting him to record and report the results of surveys and to do the various kinds of hydrographic work required by the public service. Officers are frequently called on to report on the approaches to the coast, bearings, entrances to harbors, &c., and it is often required that sketches of headlands and coasts should accompany such reports. The safety of ships depends on the clearness and accuracy of such illustrated reports, and a good knowledge of drawing is indispensable to insure this clearness and accuracy.

Very respectfully,

MARSHALL OLIVER,
Professor, Head of Department of Drawing.

Rear-Admiral C. R. P. RODGERS, U. S. N.,
Superintendent.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, by the Naval Academy.

Detailed object of expenditure, and explanation.	Estimated amount which will be required for each detailed object of expenditure.
NAVAL ACADEMY.	
Pay Naval Academy:	
One professor of drawing, head of department	$2,500 00
One professor of modern languages, head of department	2,500 00
Three professors, viz: one of physics, one of chemistry, and one of Spanish, at $2,200 each	6,600 00
Seven assistant professors, viz: four of French, two of English studies, history, and law, one of drawing, at $1,800 each	12,600 00
Sword-master, at $1,500, and two assistants, at $1,000 each	3,500 00
Boxing-master and gymnast	1,200 00
Assistant librarian	1,400 00
Three clerks to Superintendent, at $1,200, $1,000, and $800 each	3,000 00
One clerk to commandant of cadets	1,000 00
One clerk to audit cadets' accounts	1,000 00
One apothecary	750 00
One baker	600 00
One mess-man, at $288; one cook, at $325.50; and messenger to Superintendent, at $600	1,213 50
One armorer, at $529.50; gunner's mate, at $469.50; and quarter gunner, at $409.50	1,408 50
One coxswain for gymnasium, at $469.50; one seaman in department of seamanship, at $349.50; one seaman in department of astronomy, &c., at $349.50; one seaman in department of physiology and chemistry, at $349.50	1,518 00
One band-master, at $528, and 21 first-class musicians, at $348 each	7,836 00
Seven second-class musicians, at $300 each	2,100 00
	50,726 00
Amount appropriated under this head, "pay of professors and others," for the year ending 30th June, 1878	50,118 00
	*608 00
Pay of watchmen and others:	
Captain of the watch, at $2.50 per diem	912 50
Four watchmen, at $2.25 per diem, each	3,285 00
Foreman of the gas and steam-heating works of the Academy, at $5 per diem	1,825 00
Ten attendants of gas and steam-heating works: one at $3.50; one at $3; and eight at $2.50 per diem each	9,672 00
One steam-pipe fitter	547 00
Three joiners, two painters, and two masons, at $3.50 per diem each	8,942 50
One tinner, one gas-fitter, and one blacksmith, at $3.50 per diem each	3,832 50
	29,016 50
Amount appropriated for the year ending June 30, 1878	29,016 50
Pay of mechanics ond others:	
One mechanic at workshop, at $2.25 per diem	821 25
One master laborer to keep public grounds in order, at $2.28 per diem	832 20
Fourteen laborers to assist in the same: three at $2, and eleven at $1.75 per diem each	9,216 25
One laborer to superintend quarters of cadets, public grounds, &c., at $2.28 per diem	832 20

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*This excess is occasioned by the addition of one baker (at $600) for the cadets' mess.

Estimates of appropriations required, &c.—Continued.

Detailed object of expenditure, and explanation.	Estimated amount which will be required for each detailed object of expenditure.
Six attendants: one at chapel, one at recitation hall, one at offices, one at library, one at paymaster's office, and one at store, at $20 per month each	$1,440 00
Twenty servants to keep in order and attend to cadets' quarters, public buildings, &c., at $20 per month each	4,800 00
	17,941 90
Amount appropriated for the year ending June 30, 1878	17,701 90
Excess	*240 00
Pay in department of steam-engineering:	
One machinist, at $3.50 per diem	1,277 50
One machinist, at $3 per diem	1,095 00
One blacksmith, at $3.50 per diem	1,277 50
One boiler-maker, at $3.50 per diem	1,277 50
One pattern-maker, at $3.50 per diem	1,277 50
One molder, at $3.50 per diem	1,277 50
Two laborers, at $1.75 per diem each	1,277 50
	8,760 00
Appropriated for year ending June 30, 1878	8,760 00
REPAIRS AND IMPROVEMENTS.	
For the necessary repairs of public buildings, pavements, wharves, and walls inclosing the grounds of the Naval Academy; for improvements of the same, and for furniture, fixtures, &c	21,000 00
Appropriated for year ending June 30, 1878	21,000 00
Heating and lighting:	
For fuel for heating and lighting the Academy and school-ships	17,000 00
Appropriated for the year ending June 30, 1878	18,000 00
Decrease	1,000 00
GENERAL MAINTENANCE, NAVAL ACADEMY.	
For the purchase of books for the library	2,000 00
For stationery, blank-books, models, maps, &c., and for text-books for the use of instructors	2,000 00
For the expenses of the Board of Visitors	2,600 00
For the purchase of chemicals, apparatus, and instruments in the department of physics and chemistry, and for repairs of the same	5,000 00
For the purchase of gas and steam machinery, steam-pipe and fixtures, rent of buildings for the use of the Academy, freight, cartage, water, music, music and astronomical instruments, uniforms for the bandmen, telegraphing, and for the feed and maintenance of teams, and for the current expenses and repairs of all kinds, and for incidental labor and expenses not applicable to any other appropriation	34,600 00
For stores in the department of steam-engineering	800 00
For materials for repairs in steam-machinery	1,000 00
	48,000 00
Appropriated for the year ending June 30, 1878	45,500 00
Excess	†2,500 00

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*This excess is occasioned by one additional attendant to offices, &c.

† This excess is occasioned by an increase of $2,500 necessary for the purchase of chemicals and apparatus for use in the department of physics and chemistry.

RECAPITULATION.

Pay of professors and others	$50,718 00
Pay of watchmen and others	29,016 50
Pay of mechanics and others	17,941 90
Pay in department of steam-engineering	8,760 00
Repairs and improvements	21,000 00
Heating and lighting	17,000 00
General maintenance	48,000 00
Amount estimated for	192,436 40
Appropriated for year ending June 30, 1878	190,096 40
Excess	2,340 00

Respectfully submitted.

C. R. P. RODGERS,
Rear-Admiral, Superintendent.

Hon. R. W. THOMPSON,
Secretary of the Navy, Navy Department, Washington, D. C.

No. 3.—BUREAU OF YARDS AND DOCKS.

BUREAU OF YARDS AND DOCKS,
NAVY DEPARTMENT,
Washington, D. C., October 13, 1877.

SIR: In compliance with your order of the 10th instant, I have the honor to submit my annual report for the fiscal year ending 30th June, 1877, and estimates for the fiscal year ending 30th June, 1879, together with an abstract of offers for supplies coming under the cognizance of the Bureau of Yards and Docks for the fiscal year ending June, 1877.

Very respectfully, your obedient servant,

J. C. HOWELL,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy, Navy Department, Washington, D. C.

BUREAU OF YARDS AND DOCKS, NAVY DEPARTMENT,
Washington, D. C., September 29, 1877.

SIR: I have the honor to submit herewith the annual report of the operations at the several navy-yards and stations, under the cognizance of this bureau, during the fiscal year ending 30th June, 1877, together with the estimates for improvements and repairs for the fiscal year ending 30th June, 1879.

At the old navy-yards upon the Atlantic coast nothing has been done in the way of permanent improvements, the small inadequate appropriations sufficing merely to keep them in temporary repair.

At League Island, work is nearly finished upon the large steam-engineering building; the temporary wharf at the foot of Broad street has been extended to the line of twenty-one feet of water; the foundations for officers' quarters and commandant's office have been laid; a new watch-house has been built; and the mold-loft building will shortly be completed. About thirty-four acres in all have been filled in by the

American Dredging Company, under contract, and of this area about seven and a fourth acres were filled in during the past fiscal year. A causeway across the back channel has been built; plank roads laid; and a space near the commandant's office has been graded and sodded. The whole amount from the sale of the Philadelphia navy-yard, allotted by the late Secretary of the Navy to the Bureau of Yards and Docks, will have been expended by December 1, a large majority of the expenditure having been made under contracts.

At Mare Island, the appropriation for the dry-dock was only sufficient to keep so much of the dock as has been finished in condition, and to lay a small portion of granite.

I beg leave to invite your special attention to the amount asked for the continuance of the work upon the stone dry-dock at Mare Island; not a dollar was appropriated for this important work for the present fiscal year.

The necessity for a stone dry-dock at Mare Island has been recently made painfully apparent by the accident which happened to the wooden dry-dock at that navy-yard, while a man-of-war of a friendly nation was being raised. That no lives were lost upon this occasion was a matter of surprise and congratulation. Fourteen thousand dollars were needed to repair damage done to the dock.

In our eight navy-yards we have but three stone dry-docks. A single private ship-yard in England has five of solid masonry; and at Spezia, the Kingdom of Italy has in successful operation one of the greatest and most thoroughly appointed dock-yards in existence, containing an immense wet basin capable of floating the largest ship, and five or six dry-docks, which are to be increased to ten in number.

Reports from Rear-Admiral Rodgers, lately commanding at Mare Island, show a great decrease in the depth of water at the docks at that yard.

The sum asked for dredging purposes I believe to be absolutely necessary, if the yard is to be kept in working condition.

I beg to reiterate, that in my judgment the necessity for commencing the building of a permanent wharf and repairing-basin at League Island is imperative.

The yard will be comparatively useless for fitting out or repairing vessels of war until these much needed improvements shall be made.

Estimates for beginning this work will be found under the proper heading.

Railroads in navy-yards are great economizers of time and expense.

The maintenance of teams, carts, and wheels forms one of the largest items of expenditure under appropriation maintenance.

I respectfully recommend that an appropriation be asked for to increase the number of railways at Boston, New York, and Norfolk.

Our navy-yards, from inadequate appropriations, have been rapidly deteriorating during the past two years.

It would be far better that one great navy-yard should be kept in a high state of efficiency, ready for any work which might be required, than that eight should be kept open at a large expense, with half their workshops shut up and gradually going to decay for want of the necessary means to make needed reparations.

The whole sum, $100,000, appropriated for 1876-'77 could have been judiciously expended upon the New York navy-yard alone for repairs of workshops, walls, docks, and crib-work.

The bureau has been ably assisted by the commandants of the different yards and stations in making the best possible use of the small appropriation for repairs and preservation; but many wharves, workshops, docks, &c., have been merely temporarily patched up, where a wise economy called for radical repairs.

In preparing the estimates, I have endeavored, to the best of my judgment, to recommend such objects only as seemed to me of the first importance to the welfare of the naval service.

PORTSMOUTH, N. H.

The utmost economy has been exercised in the expenditures of the very limited amount which was alloted to this yard under the head of "repairs and preservation." Care has been taken to make such repairs as were of most pressing and urgent necessity so far as funds would permit, but many others have been omitted or have received but temporary attention.

There has been expended at this yard, under the head of appropriation "repairs and preservation," during the fiscal year ending 30th June, 1877—

For materials	$3,306 56	
For labor	10,661 88	
		$13,968 44

The amount expended under the head of "general maintenance" is—

For materials	6,855 02	
For labor	28,428 83	
		35,283 85
The amount expended under head of "civil establishment" is		1,953 00
Making a total expenditure of		51,205 29

The estimates submitted by the authorities at this yard for the fiscal year ending 30th June, 1879, are—

For works of improvement	$78,500 96
For repairs and preservation	49,500 00
For general maintenance	69,725 00
For civil establishment	5,900 00
Making an aggregate of	203,625 96

BOSTON, MASS.

The expenditures made during the past year under head of "repairs and preservation," were for the necessary repairs of the existing buildings, docks, wharves, &c., and these have received such repairs as the small amount allotted for the purpose would admit of; many other repairs are needed, which must be deferred for further appropriations. The amount expended under this head during the fiscal year ending 30th June, 1877, is—

For materials	$2,892 47	
For labor	14,873 95	
		$17,766 42

The amount expended under head of "general maintenance" is—

For materials	$12,002 48	
For labor	41,081 93	
		53,084 41
The amount expended under head of "civil establishment" is		3,255 00
Making a total expenditure of		74,105 83

The estimates submitted by the authorities at the yard for "new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending June 30, 1879, are—

New improvements	$195,096 86
Repairs and preservation	114,500 00
General maintenance	105,000 00
Civil establishment	7,264 50
Total estimates	421,861 36

NEW LONDON.

At this yard there has been expended during the past fiscal year, under appropriation "navy-yard, New London":

For materials	$159 03	
For labor	4,793 41	
		$4,952 44

The amount expended under head of "repairs and preservation" is—

For materials	$19 25	
For labor	432 15	
		451 40

The amount expended under "general maintenance" is—

For materials	$343 90	
For labor	4,758 58	
		5,102 48
Total expenditure		10,506 32

The estimates submitted by the yard authorities for "new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending June 30, 1879, are—

For new improvements	$437,500 00
For repairs and preservation	2,550 00
For general maintenance	30,064 00
For civil establishment	6,800 00
Total estimates	476,914 00

NEW YORK.

During the fiscal year ending June 30, 1877, there was expended at this yard, under appropriation "repairs and preservation":

For materials	$3,308 51	
For labor	15,207 02	
		$18,515 53

The amount expended under head of "general maintenance" is—

For materials	$15,416 97	
For labor	82,069 00	
		97,485 97
The amount expended under "civil establishment" is		3,248 40

The amount expended under "contingent" is—

For materials	$414 20	
For labor	1,567 37	
		1,981 57
Total expenditures		121,231 47

The estimates submitted by the yard authorities for "new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending June 30, 1879:

For new improvements	$512,950 90
For repairs and preservation	132,000 00
For general maintenance	155,000 00
For civil establishment	7,097 25
Total estimates	807,048 15

LEAGUE ISLAND.

The amount expended at this yard, under "improvements," during the fiscal year ending June 30, 1877, is—

For materials	$32,800 23	
For labor	249,996 08	
		$282,796 31

There has been expended under the head of "repairs and preservation"—

For materials		3,860 91

The amount expended under head of general "maintenance" is—

For materials	$39,409 89	
For labor	9,911 27	
		49,321 16
The amount expended under "civil establishment" is		3,394 12
The amount expended under "contingent" is		2,400 00
Total expenditures		341,772 50

The estimates submitted by the authorities of the yard for "new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending 30th June, 1879, are—

For new improvements	$1,600,000 00
For repairs and preservation	50,000 00
For general maintenance	81,000 00
For civil establishment	7,600 00
Total estimates	1,738,600 00

WASHINGTON, D. C.

The expenditures under the head of "repairs and preservation," during the fiscal year ending 30th June, 1877, are—

For materials	$5,509 86	
For labor	6,168 45	
		$11,678 31

The amount expended under head of "general maintenance" is—

For materials	$14,438 03	
For labor	39,895 09	
		54,333 12
The amount expended under "civil establishment" is		1,657 00
The amount expended under "contingent" is		1,000 00
Total expenditure		68,668 43

The estimates submitted by the authorities of the yard for "new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending 30th June, 1879, are—

For new improvements	$12,604 70
For repairs and preservation	173,679 00
For general maintenance	70,300 00
For civil establishment	5,600 00
Total estimates	

NORFOLK, VA.

The expenditures under the head of "repairs and preservation," during the fiscal year ending 30th June, 1877, are—

For materials	$5,392 03	
For labor	7,847 13	
		$12,879 16

The amount expended under general " maintenance" is—

For materials	9,547 26	
For labor	44,050 39	
		53,597 65
The amount expended under " civil establishment " is		2,871 75
The amount expended under " contingent " is		758 17
Total expenditure		70,106 73

The estimates submitted by the authorities of the yard for " new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending 30th June, 1879, are—

For new improvements	$370,679 16
For repairs and preservation	123,076 83
For general maintenance	87,596 27
For civil establishment	6,856 25
Total estimates	588,208 51

PENSACOLA, FLA.

The amount expended on new improvements during the fiscal year ending 30th June, 1877, is		$211,680 00

There has been expended under the head of " repairs and preservation "—

For materials	$2,178 78	
For labor	4,877 20	
		7,055 98

The amount expended under head of "general maintenance" is—

For materials	$4,874 44	
For labor	21,866 80	
		26,741 24
The amount expended under " civil establishment" is		1,046 25
Total expenditure		246,523 47

The estimates submitted by the authorities of the yard for "new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending 30th June, 1879:

For new improvements	$81,440 10
For repairs and preservation	111,075 09
For general maintenance	70,258 50
For civil establishment	5,600 00
Total estimates	268,373 69

MARE ISLAND, CAL.

The amount expended for "new improvements" during the fiscal year ending 30th June, 1877, was—

For materials	$3,391 57	
For labor	35,517 14	
		$38,908 71

The amount expended under "repairs and preservation" is—

For materials	$3,201 31	
For labor	16,798 46	
		$19,999 77

The amount expended under "general maintenance" is—

For materials	$15,721 47	
For labor	46,172 04	
		61,893 51
The amount expended under "civil establishment" is		3,141 00
The amount expended under head of "contingent" is		13,000 00
Total expenditure		136,942 99

The estimates submitted by the authorities of the yard for "new improvements," "repairs and preservation," "general maintenance," and "civil establishment," for the fiscal year ending 30th June, 1879, are—

For new improvements	$1,637,250 49
For repairs and preservation	174,000 00
For general maintenance	117,560 00
For civil establishment	9,200 00
Total estimates	1,938,010 49

SACKET'S HARBOR.

The amount expended at this station, under the head of "general maintenance," during the fiscal year ending 30th June, 1877, is $802.85; the amount estimated for repairs and preservation during the fiscal year ending 30th June, 1879, is $2,000.

KEY WEST, FLA.

The amount expended, under the head of "repairs and preservation," during the fiscal year ending 30th June, 1877, is—

For material	$3,775 39	
For labor	2,393 97	
		$6,169 36
The amount expended under "general maintenance" is		1,135 20
Total expenditure		7,304 56

The estimates submitted by the authorities of the station, for "repairs and preservation," and for "general maintenance," for the fiscal year ending 30th June, 1879, are—

For repairs and preservation	$13,600 00
For general maintenance	1,605 00
Total estimates	15,205 00

NAVAL ASYLUM.

There were, on the 1st July, 1876, 11 officers, 28 attendants, and 130 beneficiaries borne on the rolls of the asylum. During the fiscal year ending 30th June, 1877, thirty-six beneficiaries have been admitted; 13 have died; 6 were discharged; 3 left at their own request, and 1 was sent to the Government Asylum for the Insane.

During the past fiscal year proper care and attention has been devoted to the comfort and welfare of the beneficiaries, and, as a general rule, they conduct themselves with propriety, and appear contented and grateful for the provision made by the government for their support. Cases of insubordination occur occasionally, but these are soon suppressed by a rigid enforcement of the regulations of the institution.

The expenses of the institution during the past year are:

For subsistence	$18,260 70½
For clothing, tobacco, &c	12,353 21
For attendants	7,636 10
For repairs, care of grounds, &c	5,968 93
For miscellaneous items	8,609 99
Total expenditures	52,828 93½

Estimates have been submitted by the governor of the institution for its support during the fiscal year ending 30th June, 1879, amounting to $77,990.00.

No. 1.—*Report of expenditures at navy-yards, stations, and Naval Asylum, for fiscal year ending June* 30, 1877.

Yards and stations.	Appropriations.					
	Yard improvements.	Repairs and preservation.	General maintenance.	Civil establishment.	Contingent.	Total.
Portsmouth, N. H		$13,968 44	$35,283 85	$1,953 00		$51,205 29
Boston, Mass		17,766 42	53,084 41	3,255 00		74,105 83
New London, Conn	$4,952 44	451 40	5,102 48			10,506 32
New York, N. Y		18,515 53	97,485 97	3,248 40	$1,981 57	121,231 47
League Island, Pa	282,796 31	3,860 91	49,321 16	3,394 12	2,400 00	341,772 50
Washington, D. C		11,678 31	54,333 12	1,657 00	1,000 00	68,668 43
Norfolk, Va		12,879 16	53,597 65	2,871 75	758 17	70,106 73
Pensacola, Fla	211,680 00	7,055 98	26,741 24	1,046 25		246,523 47
Mare Island, Cal	38,908 71	19,999 77	61,893 51	3,141 00	13,000 00	136,942 99
Sacket's Harbor			802 85			802 85
Key West, Fla		6,169 36	1,135 20			7,304 56
Naval Asylum	52,828 93					52,828 93
Wharf at Erie					500 00	500 00
Total	591,166 39	112,345 28	438,781 44	20,566 52	19,639 74	1,182,499 37

No. 2.—*Detailed report from navy-yards and stations of expenditures under repairs and preservation, during the fiscal year ending June 30, 1877.*

Objects.	Portsmouth, N. H.	Boston, Mass.	New London, Conn.	New York, N. Y.	League Island, Pa.	Washington, D. C.	Norfolk, Va.	Pensacola, Fla.	Mare Island, Cal.	Key West, Fla.	Total.
Yard buildings	$7,936 44	$7,131 53	$42 61	$4,362 81	$1,163 69	$7,757 25	$2,246 72	$1,344 24	$5,838 94	$1,085 65	$38,909 88
Officers' quarters	1,477 09	1,889 80	252 58	3,021 63	665 99	228 65	2,397 08	722 20	4,684 92	....	15,339 94
Wharves, landings, bridges, and boats	835 68	326 87	11 44	2,056 23	137 03	44 98	2,573 97	3,074 05	2,385 36	4,642 26	16,087 87
Roads, walks, gutters, and drains	685 22	4,031 02	59 16	2,725 84	1,112 30	790 91	680 23	942 00	1,950 52	....	12,977 20
Fences and walls	156 18	72 00	23 49	1,050 62	1 40	430 98	572 44	253 97	1,450 44	340 20	4,351 72
Cranes, scows, and derricks	353 91	....	....	982 54	365 14	1,546 22	135 37	....	215 80	....	3,598 98
Furnaces, forges, heating apparatus, &c	770 95	675 57	18 62	1,852 57	129 50	99 60	432 61	90 63	770 19	....	4,840 24
Tracks and scales	29 24	77 25	....	96 70	107 14	163 42	3 00	....	39 60	....	516 35
Water and gas works	753 02	2,341 52	....	1,361 86	79 79	229 53	1,581 62	....	1,638 31	....	7,985 65
Dredging and scowing	....	753 48	....	785 90	....	305 09	886 66	....	7 89	....	2,739 02
Dry docks	919 95	402 75	....	13 43	16 84	....	195 44	....	....	....	1,548 41
Miscellaneous repairs	50 76	64 63	43 50	205 40	82 09	81 68	1,174 02	628 89	1,017 80	101 25	3,450 02
Total	13,968 44	17,766 42	451 40	18,515 53	3,860 91	11,678 31	12,879 16	7,055 98	19,999 77	6,169 36	112,345 28

No. 3.—*Detailed report of expenditures, under general maintenance, received from yards and stations during the fiscal year ending June 30, 1877.*

Objects.	Portsmouth, N. H.	Boston, Mass.	New London, Conn.	New York, N. Y.	League Island, Pa.	Washington, D. C.	Norfolk, Va.	Pensacola, Fla.	Mare Island, Cal.	Sacketts Harbor, N. Y.	Key West, Fla.	Total.
Freights and transportation	$3 75	$2 90	$61 03	$187 20	$6 25	$2 50	$1 90	$10 00	$6,912 23	....	....	$7,187 76
Printing, stationery, and advertising	155 14	64 35	....	1,522 07	1,997 82	1,452 23	944 30	296 40	1,109 36	....	....	7,541 67
Books, maps, models, and drawings	....	29 50	....	1,117 00	370 70	29 08	354 00	....	2,166 21	....	....	4,066 49
Purchase and repair of fire-engines	1,019 41	1,105 00	....	334 49	281 84	1,225 64	318 89	1,460 90	1,553 36	....	....	7,299 53
Machinery of every description and patent-rights	75 00	9 53	....	113 45	2,249 85	2,525 94	304 38	376 63	4,031 95	....	....	9,686 73
Repairs on steam-engines and attendance on same	....	1,320 45	....	2,221 82	536 34	....	1,932 23	779 03	2,367 36	....	....	9,157 23
Purchase and maintenance of oxen and horses, pay of hired teams, &c	5,609 11	8,441 26	94 15	11,091 13	9,710 94	2,997 50	9,530 16	2,907 21	9,273 38	....	....	59,654 84
Carts, timber, wheels, and tools of every description	1,938 08	2,320 64	47 30	3,114 15	1,399 99	1,450 71	7,088 34	919 55	2,183 60	....	....	20,462 36
Postage on letters on public service and telegrams	45 24	157 87	4 00	92 90	410 56	35 95	109 73	900 00	14 52	....	....	1,770 77
Furniture for government houses and offices in navy-yards	2,475 60	225 37	....	2,474 50	72 77	1 114 22	2,307 29	185 25	1,934 33	....	....	10,789 33
Coal and other fuel for yards and docks purposes	2,200 97	1,729 95	162 75	1,330 64	1,939 90	2,855 69	961 81	943 75	1,955 25	....	....	14,080 71
Candles, oil, and gas	2,352 28	2,298 62	....	3,461 25	397 57	1,455 75	2,763 47	670 04	6,577 52	....	....	19,976 50
Clearing and cleaning up yard and care of buildings	4,499 66	5,715 14	1,015 84	8,293 29	2,227 58	18,093 90	6,061 65	7,887 67	3,878 37	....	....	57,673 10
Attendance on fires, lights, fire-engines, and apparatus	3,206 92	3,675 66	....	7,196 10	8,240 98	2,316 50	3,906 76	563 56	1,642 22	....	....	30,748 70
Incidental labor not chargeable to other appropriations	4,821 57	1,185 80	1,400 00	17,106 20	5,863 83	7,367 02	3,821 89	977 40	5,063 74	$802 85	$40 20	48,450 50
Water-tax	100 00	4,456 07	62 04	4,471 38	....	....	22 20	173 85	5,381 05	....	....	14,666 59
Tolls and ferriages	23 63	....	44 60	182 50	....	....	337 51	....	2,981 56	....	....	3,569 80
Pay of watchmen	6,642 54	20,298 00	2,210 77	33,135 90	13,535 64	11,333 00	12,706 22	7,620 00	2,797 22	....	1,095 00	111,374 29
Flags, awnings, and packing-boxes	114 95	48 39	....	40 00	78 60	77 49	124 92	70 00	70 28	....	....	624 54
Rent of landing	....	....	....	....	....	....	....	....	....	....	....	....
Total	35,283 85	53,084 41	5,102 48	97,485 97	49,321 16	54,333 12	53,097 65	26,741 24	61,893 51	802 85	1,135 20	438,781 44

No. 4.—*Estimates received from navy yards, stations, and Naval Asylum, for fiscal year ending June* 30, 1879.

Yards and stations.	Appropriations.				Total.
	Yard improvements.	Repairs and preservation.	General maintenance.	Civil establishment.	
Portsmouth	$78,500 96	$49,500 00	$69,725 00	$5,900 00	$203,625 96
Boston	195,096 86	114,500 00	105,000 00	7,264 50	421,861 36
New London	437,500 00	2,550 00	30,064 00	6,800 00	476,914 00
New York	512,950 90	132,000 00	155,000 00	7,097 25	807,048 15
League Island	1,600,000 00	50,000 00	81,000 00	7,600 00	1,738,600 00
Washington	12,604 70	173,679 00	70,300 00	5,600 00	262,183 70
Norfolk	370,679 16	123,076 83	87,596 27	6,856 25	588,208 51
Pensacola	81,440 10	111,075 09	70,258 50	5,600 00	268,373 69
Mare Island	1,637,250 49	174,000 00	117,560 00	9,200 00	1,938,010 49
Sacketts Harbor		2,000 00			2,000 00
Key West		13,600 00	1,605 00		15,205 00
Naval Asylum	77,990 00				77,990 00
Total	5,004,013 17	945,980 92	788,108 77	61,918 00	6,800,020 86

No. 5.—*Detailed estimates from navy yards and stations, for repairs and preservation, for the fiscal year ending June 30, 1879.*

Objects.	Portsmouth, N. H.	Boston, Mass.	New London, Conn.	New York, N. Y.	League Island, Pa.	Washington, D. C.	Norfolk, Va.	Pensacola, Fla.	Mare Island, Cal.	Sacket's Harbor, N. Y.	Key West, Fla.	Total.
Yard buildings	$25,000 00	$35,000 00	$600 00	$35,000 00	$12,000 00	$58,559 00	$50,227 74	$26,482 89	$20,000 00	$2,000 00	$2,000 00	$266,869 63
Officers' quarters	4,500 00	10,000 00	500 00	3,000 00	800 00	5,000 00	5,236 92	26,661 64	10,000 00	....	....	65,698 56
Wharves, bridges, landings, and boats	4,500 00	12,000 00	400 00	30,000 00	10,500 00	33,070 00	3,648 26	24,706 03	15,000 00	....	11,200 00	145,024 29
Roads, walks, gutters, and drains	3,000 00	8,500 00	350 00	20,000 00	5,000 00	4,000 00	22,519 02	10,158 90	8,000 00	....	....	81,527 92
Fences and walls	300 00	2,000 00	250 00	2,500 00	500 00	22,000 00	6,763 45	6,500 63	6,000 00	....	100 00	46,914 08
Cranes, scows, and derricks	4,000 00	3,000 00	....	3,000 00	2,000 00	7,800 00	9,160 05	677 00	10,000 00	....	....	39,637 05
Furnaces, forges, heating apparatus, &c	3,000 00	2,500 00	50 00	5,000 00	1,000 00	14,250 00	680 30	427 00	4,000 00	....	....	30,907 30
Tracks and scales	100 00	5,000 00	....	1,500 00	2,000 00	1,500 00	2,340 78	1,025 00	5,000 00	....	....	18,465 78
Water and gas works	3,500 00	5,500 00	....	4,000 00	700 00	1,500 00	4,904 85	6,586 00	6,000 00	....	....	32,690 85
Dredging and scowing	....	1,000 00	....	20,000 00	500 00	11,000 00	11,676 18	....	20,000 00	....	....	64,176 18
Dry-docks	1,500 00	25,000 00	....	3,000 00	5,000 00	10,000 00	2,482 11	5,000 00	52,000 00	....	....	103,982 11
Miscellaneous repairs	100 60	5,000 00	400 00	5,000 00	10,000 00	5,000 00	3,437 17	2,850 00	18,000 0	....	300 00	50,087 17
Total	49,500 00	114,500 00	2,550 00	132,000 00	50,000 00	173,679 00	123,076 83	111,075 09	174,000 00	2,000 00	13,600 00	945,980 92

No. 6.—*Detailed estimates for general maintenance received from yards and stations for the fiscal year ending June 30, 1879.*

Objects.	Portsmouth, N. H.	Boston, Mass.	New London, Conn.	New York, N. Y.	League Island, Pa.	Washington, D. C.	Norfolk, Va.	Pensacola, Fla.	Mare Island, Cal.	Key West, Fla.	Total.
Freight and transportation	$50 00	$100 00	$100 00	$200 00	$100 00	$50 00	$100 00	$1,000 00	$9,000 00	....	$10,700 00
Printing, stationery, and advertising	500 00	1,200 00	400 00	2,000 00	2,000 00	1,500 00	1,500 00	850 00	3,500 00	....	13,450 00
Books, maps, models, and drawings	100 00	150 00	200 00	1,000 00	500 00	50 00	1,002 83	100 00	4,700 00	....	7,802 83
Purchase and repair of fire-engines	10,000 00	3,000 00	....	5,000 00	800 00	500 00	2,884 39	4,746 25	2,000 00	....	28,930 64
Machinery of every description and patent rights	100 00	1,500 00	3,000 00	3,000 00	5,000 00	2,000 00	4,034 89	5,410 00	4,000 00	....	28,044 89
Repairs on steam-engines and attendance on same	100 00	3,500 00	3,000 00	4,000 00	2,000 00	11,000 00	2,124 12	5,737 50	5,000 00	....	36,461 62
Purchase and maintenance of oxen and horse, pay of hired teams, &c	7,000 00	25,000 00	5,000 00	30,000 00	15,000 00	4,500 00	15,915 83	6,265 00	20,000 00	....	128,680 83
Carts, timber wheels, and tools of every description	2,500 00	10,000 00	4,000 00	7,000 00	5,000 00	2,000 00	7,061 46	5,760 00	3,500 00	$10 20	46,861 66
Postage on letters on public service, and telegrams	50 00	250 00	100 00	200 00	500 00	50 00	150 00	1,400 00	60 00	....	2,760 00
Furniture for government houses and offices in navy-yards	10,000 00	2,000 00	500 00	6,000 00	1,000 00	3,000 00	7,288 35	5,400 00	6,000 00	....	41,188 35
Coal and other fuel for yards and docks purposes	6,500 00	5,000 00	2,700 00	5,000 00	2,500 00	3,000 00	2,137 44	1,100 00	7,000 00	....	34,957 44
Candles, oil, and gas	2,500 00	3,000 00	84 00	6,000 00	500 00	1,600 00	3,100 00	1,312 50	9,500 00	....	27,596 50
Clearing and cleaning up yard and care of buildings	6,000 00	10,000 00	2,000 00	10,000 00	8,500 00	15,000 00	6,598 36	11,021 30	2,000 00	....	71,119 66
Attendance on fires, lights, fire-engines, and apparatus	5,000 00	5,500 00	....	8,000 00	9,000 00	4,000 00	5,009 90	506 55	3,000 00	....	40,016 45
Incidental labor not chargeable to other appropriations	6,000 00	2,500 00	4,200 00	20,000 00	15,000 00	10,000 00	10,000 00	5,479 80	11,000 00	....	84,179 80
Water-tax	100 00	11,000 00	100 00	7,000 00	....	....	30 00	201 60	5,700 00	....	24,131 60
Tolls and ferriage	50 00	....	100 00	300 00	....	....	300 00	180 00	3,000 00	....	3,930 60
Pay of watchmen	13,000 00	21,000 00	4,380 00	40,000 00	13,500 00	12,000 00	17,979 90	13,338 00	18,000 00	1,095 00	154,292 90
Flags, awnings, and packing-boxes	100 00	300 00	200 00	300 00	100 00	50 00	378 80	450 00	600 00	....	2,478 80
Rent of landing	75 00	....	....	....	....	....	....	....	....	....	75 00
Total	69,725 00	105,000 00	30,064 00	155,000 00	81,000 00	70,300 00	87,596 27	70,258 50	117,560 00	1,135 20	787,638 97

No. 7.—*Bureau's estimates for navy-yards, stations, and Naval Asylum, for fiscal year ending June* 30, 1879.

Yards and stations.	Appropriations.					
	Yard-improvements.	Repairs and preservation.	General maintenance.	Civil establishment.	Contingent.	Total.
Portsmouth	$47,000 00	$39,000 00	$53,000 00	$4,417 75		$143,417 75
Boston	103,869 00	90,000 00	80,000 00	4,417 75		278,286 75
New London		2,550 00	10,000 00	1,017 25		13,567 25
New York	107,000 00	100 000 00	90,000 00	6,921 25		303,921 25
League Island	500,000 00	40,000 00	60,000 00	6,921 25		606,921 25
Washington		90,000 00	70,000 00	4,417 75		164,417 75
Norfolk	125,000 00	90,000 00	70,000 00	5,356 25		290,356 25
Pensacola	125,000 00	80,000 00	60,000 00	2,417 25		267,417 25
Mare Island	629,212 00	100,000 00	80,000 00	6,921 25		816,133 25
Sackett's Harbor		2,000 00				2,000 00
Key West	30,000 00	13,600 00	1,605 00			45,205 00
Naval Asylum	64,434 00					64,434 00
Contingent					$25,000 00	25,000 00
Total	1,731,515 00	647,150 00	574,605 00	42,807 75	25,000 00	3,021,077 75

The aggregate amount of estimates from the different yards and stations for improvements is large, being $4,926,023.17. This amount has been much reduced, but owing to the fact that very small appropriations have been made for several years past, and that some large and costly works which have heretofore been in progress and which are now suspended for want of appropriations, it is believed that the estimates submitted are no more than can be judiciously expended, and are such as the good of the service requires.

At the navy-yard, Portsmouth, N. H.

For repairing floating-dock	$9,000 00
For paving gutters and drains	5,000 00
For water-works	3,000 00
For timber-shed	30,000 00
	47,000 00

The floating dry-dock is the most costly and important work in the yard, and is of perishable materials. No extensive repairs have been made for some years, and the sides, sloping ribs, and end gate now require calking and painting, and some of the planking should be renewed.

These repairs are of the utmost importance, as the dock is the only means in this harbor by which access can be obtained to the bottoms of vessels needing repairs.

A small appropriation for paving gutters and drains is much needed, as in some places water stands after rains, and in others a considerable space drains into the dry-dock basin, carrying sediment, which endangers the dock and ship when one is landed or docked to be taken on shore.

On Seavey's Island several artificial ponds or reservoirs have been constructed, which are fed by springs, affording an abundant supply of pure fresh water. The elevation of these reservoirs is such as to supply the cisterns in the yard, and their capacity is quite sufficient to furnish good pure water for all the purposes of the yard; and, to render the arrangement complete, a small appropriation is needed for furnishing and laying the necessary pipes. The object is an important one.

Increased accommodations for the stowage and safe-keeping of timber is much needed at this yard. Large quantities of valuable material are exposed to the weather, which causes rapid deterioration, and the annual loss from this cause is very great. The saving which would be realized by proper protection would soon pay for the cost of the building.

At the navy-yard, Boston.

For boundary-wall	$10,000 00
For cart-shed	10,000 00
For yards and docks workshops	50,000 00
For paving and grading and extension of rail-tracks	15,000 00
For new floor to rope-walk	18,869 00
	103,869 00

An appropriation for the boundary-wall on the southwesterly side of the yard is most urgently required for the protection of the large amount of public property stored in the vicinity.

At this point the government property is bounded by property belonging to the Fitchburg Railroad Company, on which is stored a large quantity of coal. The present division is an old dilapidated wooden shed and fence, affording no protection whatever against the ingress of depredators who may desire to enter the yard for plunder or incendiary purposes.

This old fence is 450 feet long, reaching to deep water, and should a fire occur there, either through accident or design, the loss to the government would be immense. It is earnestly hoped that an appropriation will be made for this object.

The great necessity of a good, substantial building, capable of accommodating and protecting all the wagons, carts, timber wheels, and all other vehicles belonging to the yard, has long been felt, and for the safety and proper protection of this property the improvement is absolutely indispensable.

The deterioration of the implements from exposure to the sun, rains, and snows is very great, and the consequent cost of repairs is a large item of expense.

The present wooden shed is far beyond repair, very old, and in a dilapidated condition.

The buildings occupied by the department .of yards and docks for workshops and storage are not suited to the wants of the department; they are located in different parts of the yard, most of them being small, unsightly, dilapidated wooden sheds, and entirely unsuitable for the purposes for which they are used, and it causes the department much extra labor and expense in carrying on the work.

The construction of a proper building on the site of the building No. 54 would concentrate nearly all the civil engineer's forces, and at the same time remove an old wooden structure and lessen the chances of fire.

Some of the streets in this yard are neither graded nor paved, and, as they are much used in the transportation of materials, they are often in a condition to render hauling difficult; and an appropriation is much needed for their improvement and for extending the rail-tracks.

The floor of the rope-walk is in a very bad condition, is frequently giving way, and, as the bureau has had no funds at its disposal for a thorough repair, temporary repairs have been made from time to time, causing interruption in the manufacture of cordage. A new floor should be put in this important building; and an appropriation for this purpose is strongly urged.

At the navy-yard, New York.

For timber-shed	$50,000 00
For coal-depot	20,000 00
For retaining crib-work	30,000 00
For fire-engine house	7,000 00
	107,000 00

One of the objects of first importance and necessity at this yard is an increase in the accommodations for the storage of timber and plank, large quantities of which are now in the yard unprotected from the effects of the weather and subject to rapid decay. The loss occasioned by the deterioration of this valuable and costly material would soon be equal to the cost of the building, and the early construction of this shed would therefore be a matter of economy.

The expense of hauling the large quantities of coal used at this yard is very great, and it is proposed to adopt a plan now in use at Amboy and other places, where, by the use of machinery, a vast saving is made in both time and money. The plan is a good one, and it is hoped the appropriation will be made.

Some protection is needed to the yard along the boundary-line from the channel to Washington avenue, and for this purpose it is proposed to construct a crib-work 60 feet within the government line, by which arrangement a slip 60 feet wide will be secured, and the inside of the crib-work would form the northerly boundary of the timber-basin, and upon which timber could be landed in close proximity to the basin.

The length of this is 760 feet, and borders on a slip 70 feet wide belonging to the city of Brooklyn.

The authorities of that city and the harbor commissioners have complained and still complain that the alluvium from this unprotected water-front of the government lands is constantly passing into their slip, and also into the channel, and obstructing navigation in that quarter.

It is to obviate these complaints, and to protect and improve the government property, that an appropriation is asked for this object. It is an important one, and would add greatly to the protection and usefulness of that section of the yard.

The place now used for a fire-engine house is an old dilapidated shed, requiring constant repairs, and is entirely unsuitable for the purpose. In the shed the fire-engine horses are kept, while the other horses are stationed in another portion of the yard. The proposed plan will permit all the horses being kept in the new stables, and furnish all the necessary conveniences for the men and machines, and for quick transit in case of fire.

At the navy-yard, League Island.

For commencing quay-wall on Delaware avenue	$60,000 00
For commencing floating-dock basin	255,000 00
For dredging and filling in	50,000 00
For yard buildings	75,000 00
For water, gas, and sewerage	30,000 00
For grading, graveling, and paving	20,000 00
For temporary embankments	5,000 00
For roads and rail-tracks	5,000 00
	500,000 00

In executing the plan proposed for the development of this yard, one of the first objects of improvement should be the construction of a permanent quay-wall along the Delaware front. This will protect the yard from inundation in that quarter, provide landing places for materials and berths for vessels, and the early commencement of its construction is regarded of great importance, as it is a work of great magnitude, and will require large appropriations and much time for its completion.

The commencement of the floating-dock basin is a work that should be provided for at once, as there are no means at present by which access can be had to the bottoms of vessels requiring repairs. We have a floating-dock at the yard, but there is no place yet prepared for its use, and unless an appropriation is made at once to secure a proper place for its operation, the dock will remain useless and subject to great deterioration. The estimates for dredging and filling in is sufficient to raise to the established grade that part of the yard adjacent to five building-ways and the yard buildings embraced in the estimates, and also for completing the filling in on the north side of the back channel from Broad street easterly 1,100 feet, and the same distance westerly. This filling in should be done as soon as practicable, so that the material may become well settled by the time such newly-filled portions of the yard shall be needed for use.

Under head of water, gas, and sewerage is submitted an estimate for the commencement of works for the permanent watter-supply of the yard, and for putting down water, gas, and sewer-pipes in Broad street.

For grading, graveling, and paving is estimated a sum sufficient to commence the grading, graveling, and paving of Broad street, and to grade and commence the graveling of the grounds and streets in the vicinity of the quay-wall, dock-basin, and buildings.

The temporary embankments around the island require enlarging, in order to better resist the action of the water, and for that purpose the sum estimated is deemed necessary in addition to the ordinary allotment for general repairs.

It is an important object, as, unless proper care is taken of the embankments, the island is liable to be flooded by freshet.

The enlargement of the filled area of the yard will require a considerable extension of the temporary plank-roads and rail-tracks, and an estimate is, therefore, submitted for those objects.

At the navy-yard at Norfolk, Va.

For timber-shed No. 32	$35,000 00
For timber-shed No. 33	35,000 00
For chain and cordage store No. 12	20,000 00
For railroad and engine-house	15,000 00
For extension of quay-wall	20,000 00
	125,000 00

The limited amount of accommodations for the storage and protection of timber at this yard is a source of great loss and inconvenience. Very large quantities of costly and valuable ship-timber have been accumulated here for future use, most of which is exposed to the weather and subject to rapid decay. Such timber cannot always be readily obtained when wanted, and it is wise policy to keep a good stock on hand, that it may be thoroughly seasoned when needed for use. An appropriation for the sheds is regarded as of great importance and necessity.

The appropriation for chain-cable and cordage store is greatly needed; a very large quantity of chains is now stowed outside, exposed to the weather, there being no building for their protection; the present storage-room for sails and cordage is so limited as to cause great inconvenience and loss, and additional space for these materials is greatly needed.

The railroad and engine-house.—The building, in connection with a system of railroad-tracks, locomotives, and cars connecting all the shops and storehouses with the dry-dock and wharves, in order to facilitate the transportation of materials about the yard, and to reduce the present cost of the same, is an object of great importance, as the cost of transporting heavy materials about the yard by means of oxen and horses is one of our largest items of expense under general maintenance.

The extension of the quay-wall is a work of great importance as a permanent improvement, and as preventive to the large annual expenditure for repairs to the wooden wharves, which in this climate decay rapidly.

At the navy-yard, Pensacola.

For timber shed No. 11	$38,356 00
For machine-shop for steam-engineering	86,644 00
	125,000 00

Timber-shed No. 11 is much needed for the protection of timber and lumber belonging to the Bureau of Yards and Docks. This bureau has barely storage-space for the protection of a small quantity of planed lumber, all of its rough timber and lumber being exposed alternately to the rays of the sun and the frequent rains of summer, which, in this climate, causes rapid decay and much loss. The cost of the building would soon be saved by proper protection of the materials from the effects of the weather, which are very damaging.

The facilities for doing work in the machinist department at this yard are very limited, and as the machinery of vessels attached to the Gulf squadron often requires repairs of more or less importance, it is thought that a proper shop should be provided at this station, and an estimate for the building is therefore submitted:

At the navy-yard, Mare Island, Cal.

For continuation of stone dry-dock	$400,000 00
For removal of gas-holder and gas-works	6,750 00
For completing water-mains and service-pipes for reservoir	27,462 00
For roads, pavements, and railways	25,000 00
For extension of timber-shed No. 94	20,000 00
For dredging and scowing	100,000 00
For commencing quay-walls and wharves	50,000 00
	629,212 00

With such a meager allotment as was appropriated for construction of stone dry-dock during the last year, it was impossible to do more than keep the premises and working appliances in a reasonable degree of order.

The entire failure to appropriate anything to carry on the work upon the stone dock during the present fiscal year is a misfortune, the extent of which will be appreciated when work recommences upon it.

The last annual report gave in detail the reasons for which the continuous prosecution of the work is urged; it seems proper to again present some of them.

The peculiar circumstances under which a stone dry-dock must be built render its construction one of difficulty and hazard, and therefore demands, as far as possible, prompt and continuous operations. The whole foundation (a very large portion of its masonry resting upon a level many feet below tide-water) requires protection while being laid by a coffer-dam, of a necessarily temporary character, whose continuation is not calculated upon, except for about the time that its use ought to be required in the uninterrupted construction of the work it is intended to secure. Its iron fastenings are exposed to the corrosive action of salt water, and thus, sooner or later, must become too weak for its safety; other influences of water-pressure, the action of waves, and general wear and tear in the course of time must add their impairing effect and impose the necessity of continued repairs, whose cost increases in proportion to the length of time such structures are maintained; other obvious reasons urge the completion of dry-docks as speedily as their nature permits.

It seems proper to state as an additional reason for speedily completing this work that the sectional wooden dock, on which we at present solely depend for docking vessels, cannot be depended upon much longer without very extensive repairs, if not entire renewal. In either event the cost of such work must be great, and wisdom would seem to dictate its prevention by carrying the stone dock at once to completion.

The bureau therefore urges the provision of sufficient means for pushing the stone dock during the coming fiscal year as far as it can be carried.

If the stone for the entrance can be provided and laid and the caisson finished, the structure can be put in a suitable state for completion the following year, provided the remaining necessary funds be then furnished.

The location of the stone-dock pumping-house and well between the wings of the smithery, No. 69, as recommended in the report of the board of civil engineers of November, 1873, necessitates the removal of the present gas-holder, which is situated on these premises. It is proposed to remove the whole of the gas-works to block No. 51, which by the engineer's report is assigned for such purposes. The estimate includes a convenient but temporary building and the use of the present works, as it is believed they will serve until a more extensive and permanent establishment can be provided. For the completion of the yard water-distribution-system nothing remains to be done but to continue the laying of the pipes from the reservoir to the point in the yard where the finished main now terminates, at house No. 14, and to provide the necessary branch-mains and service-pipes to the stables and other still unprovided establishments. The extension of the main now in connection with the Vallejo Water Company's works to the yard-reservoir provides for its additional supply from those works in case it should be needed, and at the same time answers for a distributing-pipe for general service. This arrangement supposes that a single main can perform only one of these duties at a time; but from the connection of the Vallejo pipe with its high reservoir, recently effected, and which gives a head of about 150 feet above the coping of the quay-wall, the service of supply to the yard-reservoir can be operated on occasions when there will be little consumption of water, say in the night-time, and the use of the pipe for distribution will not then be needed.

The plan originally contemplated the erection of pumping-works on the yard, supposing that the Vallejo supply would continue direct from the company's pond, and would necessitate pumping to raise it to the higher level of the yard reservoir, and the present estimate provides for the carrying out of this design, anticipating the possibility of its necessity in case a satisfactory arrangement with the Vallejo company cannot be made for a supply from its high reservoir, now supplied through steam-power, which would involve on their part the expense of pumping beyond their local consumption the additional quantity of water that the yard may require.

Roads and pavements.—The want of good roads, as an adequate water-supply, has long been severely felt at this yard, and no improvements are more needed than these; without them all others lose a great part of their efficiency. In wet weather, owing to the natural quality of the soil whereon the yard routes of travel lie, they become almost impassable to teams, and many important points are inaccessible owing to the prevalence of deep mud. The appropriation is one of great importance and necessity, and is strongly urged by the bureau.

Extension of timber-shed No. 94.—The accumulation of large supplies of timber on the yard, and the great want of buildings for sheltering such material from the deleterious effects of the weather of this peculiar climate, necessitates the erection of more timber-sheds. The increasing wants of the yard for workshops and store-rooms has forced the appropriation of buildings originally intended in part for timber-sheds to these purposes, and there is now available only one building for storing wood materials, and this of limited capacity. As the site of the present shed No. 94 is assigned by the board of civil engineers for another purpose, and the shed itself will consequently have to be removed eventually, it is here proposed to extend the building only in a temporary manner.

The roof-frame of the old ordnance building may be made available for this purpose, and its use will savemuch cost; the remainder of the work will be of wood, and so put up as to afford a shelter for the materials that will be stored therein. The site for the extension is now filled in.

Dredging and scowing.—For maintaining a proper depth of water in the vicinity of the wharves and at the landings, the operation of dredging is indispensable; its efficiency and economy, however, may be greatly increased by the adoption of some system that will utilize the excavated material by depositing upon the tule-lands belonging to the island, instead of towing it several miles and dumping it overboard to be again deposited in the channel. With the view of providing suitable machinery and apparatus to secure this desirable end, the bureau submits this estimate and urges the appropriation.

Commencing quay-wall and wharves.—The location and system of quay-walls, as recommended by the board of civil engineers, ought to be at once undertaken, not only for the purpose of supplying the necessities of the national shipping, but for the maintenance of the yard water-front and its proper channel. An improvement of this kind must be considered fundamental for the essential purposes of a navy-yard, and should be undertaken in the early stages of its development and continued until a reasonable provision is made to meet the demands which are likely to arise in the future.

The present irregular water-front causes eddies and deposits, and this renders the almost constant use of dredging-machines a necessity.

With a straight line of quay-wall, presenting no obstructions to the natural currents of the river, as is now proposed, it is confidently believed that the currents sweeping along this uninterrupted line will scour the bottom and give a line of wharfage accessible at all times.

This is one of the most important objects for which appropriations are asked.

It is a work of great magnitude, will require several years for its entire completion, and should be commenced as soon as possible.

KEY WEST, FLORIDA.

The amount asked for this station is for rebuilding the main landing, which was partially destroyed during the late storms.

This station is one of importance to our Gulf squadron as a coal-depot, and where slight repairs can be made. The wharf is the only landing on the government property, and the usefulness of the station depends greatly upon its being kept in proper condition for the landing and shipping of coal and other materials and stores.

REPAIRS AND PRESERVATION.

The amount submitted under this head, $647,150, is very much less than the estimates received from the various yards, though considerably more than the allocments for the past and present fiscal years. The amounts appropriated for this object for the last and present fiscal years were entirely inadequate for the purpose, and the bureau has been compelled to postpone many repairs which are absolutely necessary for the proper protection of the public property.

It is hoped that Congress, at its next session, will exhibit a spirit of wise liberality by appropriating for this object the sum asked for by the bureau.

GENERAL MAINTENANCE.

The amount submitted under this head, $574,605, is much less than the estimates submitted from the various yards, and it is believed to be no more than is actually necessary to meet the numerous demands upon this fund from the various yards and stations. The pay of watchmen at the several navy-yards and stations is an unavoidable expense, and amounts to a large percentage of the appropriation asked for. Other necessary expenses, such as purchase and maintenance of oxen and horses, carts, timber-wheels, coal and other fuel, candles, oil and gas, cleaning and clearing up yards, attendance on fires, fire-engines and apparatus, and water-tax, amount to a large sum, which cannot be curtailed without detriment to the public service.

CIVIL ESTABLISHMENT.

The estimate for this branch of the service is precisely the same as has been allotted to this bureau for the present fiscal year, and cannot be reduced without embarrassment to the bureau and injury to the service.

CONTINGENT.

This fund is to defray the expense of any unforeseen casualty which may occur during the fiscal year, and its expenditure is always carefully guarded.

The amount, $25,000 for all the yards, is small and will not be expended unless demanded by actual necessity.

NAVAL ASYLUM.

The amount estimated for this institution, for pay of attendants, support of beneficiaries, and necessary repairs of buildings, furniture, furnaces, grates, and care of public grounds, is $64,434, a trifle more than was asked for last year, owing to the fact that some of the buildings require an unusual amount of repairs. The expense of this institution is by law paid out of the Navy pension fund.

Accompanying this report is an abstract of offers for supplies received for furnishing articles coming under the cognizance of the Bureau of Yards and Docks, made in conformity to the act of Congress approved March 3, 1843.

The following estimates for the fiscal year ending June 30, 1879, are respectfully submitted:

Sheet No. 1. For support of Bureau of Yards and Docks	$13,560 00
Sheet No. 2. For general maintenance of yards and docks and contingent	599,605 00
Sheet No. 3. For support of Naval Asylum	64,434 00
Sheet No. 4. For repairs and preservation of navy-yards	647,150 00
Sheet No. 5. Improvements at navy-yards	1,667,081 00
For civil establishment	42,807 75
	3,034,637 75

I am, very respectfully, your obedient servant,

J. C. HOWELL,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

ABSTRACT OF OFFERS FOR SUPPLIES RECEIVED FOR FURNISHING ARTICLES COMING UNDER THE COGNIZANCE OF THE BUREAU OF YARDS AND DOCKS, MADE IN CONFORMITY TO THE ACT OF CONGRESS APPROVED MARCH 3, 1843.

Offers for supplies for the League Island navy-yard, under advertisement dated November 25, 1876, required on requisitions Nos. 66 *and* 67.

Requisition No. 66. White pine boards:

Maule Bros. & Co.	$242 00
H. Bayard & Co.	252 75
J. W. Gaskill & Son	*240 65

Requisition No. 67. White pine boards:

Maule Bros. & Co.	$240 00
H. Bayard & Co.	249 00
J. W. Gaskill & Son	*238 80

Offers for supplies for the League Island navy-yard, under isement dated November 29, 1876, *required on requisitionadverts Nos.* 68 *and* 69.

Requisition No. 68. Screws:

Noblit, Brown, Noblit & Co.	$77 95
Paul J. Field	*76 82
Field & Hardie	82 78

Requisition No. 69. White-pine weather-boarding:

H. Bayard & Co.	$300 00

Requisition No. 69. White-pine weather-boarding—Continued.

J. W. Gaskill & Son	$255 00
J. W. Gaskill & Son, if planed	*285 00
Maule Bros. & Co., if planed	290 00
Maule Bros. & Co., not planed	260 00

Offers for supplies for the League Island navy-yard, under advertisement dated December 2, 1876, *required on requisitions Nos.* 70 *and* 71.

Requisition No. 70. Iron:

Dell Noblit, jr.	$119 19
Morris, Wheeler & Co.	*94 97

Requisition No. 71. Kerosene oil:

Stevenson Bros. & Co.	$50 00
Paul A. Davis, jr.	60 00
Thackara, Buck & Co.	*43 00

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*Accepted.

Offers for supplies for the League Island navy-yard, under advertisement dated December 6, 1876, required on requisition No. 73.

Requisition No. 73. 1,470 feet drain-pipes:	
Haney & Adamson	*$251 53
O. O. Bowman & Co.	257 00
Requisition No. 73. 1,470 feet drain-pipes—Continued.	
Moorhead Clay Works	$270 35

Offers for furnishing bricks, lime, and cement required for the Washington navy-yard, under advertisement dated December 4, 1876.

110,000 machine-made red brick:	Per M.
John W. Myers	$6 95
Windsor & Ford	*6 50
Washington Brick-making Company	6 93
Washington Brick-making Company, hard red	7 47
50 barrels lime:	Per bbl.
Bird & Hepburn	*$1 20
L. W. Guinand	$1 30
John A. Baker	1 47
Cammack & Edmonston	1 25
50 barrels cement:	
Bird & Hepburn	*$1 55
L. W. Guinand	1 60
John A Baker	1 57
Cammack & Edmonston	1 60

Offers for furnishing one hundred barrels of cement for the Mare Island navy-yard, under advertisement dated December 8, 1876.

Rosendale cement:	
F. B. Taylor & Co.	*$299 00
A. T. Holmes & Co.	$300 00
George F. Bragg & Co.	347 00

Offers for supplies for the League Island navy-yard, under advertisement dated December 13, 1876, required on requisition No. 77.

300 tons Lehigh egg coal:	Per ton.
Lehigh & Wilkesbarre Coal Company	$4 85
Branson & Bro.	$5 00
John Street & Co.	*4 12½
Bright & Thomas	4 14

Offers for furnishing 225 barrels hydraulic cement for League Island navy-yard, required on requisitions 78 and 79, under advertisement dated December 20, 1876.

225 barrels cement:	Per bbl.
Benj. Allen	$1 90
Lesley & Trinkle	1 55
Lesley & Trinkle (not for cement required)	$1 75
Paul A. Davis, jr.	1 65
Charles R. Wilson	*1 37

Offers for furnishing articles required on requisitions Nos. 81 and 82 for League Island navy-yard, under advertisement dated December 21, 1876.

Requisition No. 81. Spikes:	
Noblit, Brown, Noblit & Co.	*$32 50
Field & Hardie	35 00
Paul J. Field	34 90
Requisition No. 81. Glass and oil:	
Russell & Landis	237 40
W. F. Simes & Son	*196 00
United States White-Lead Co.	210 40
Requisition No. 82. Astral oil, brushes, &c.:	
Noblit, Brown, Noblit & Co.	$73 30
Thackara, Buck & Co.	*59 80
Paul A. Davis, jr.	60 00
Requisition No. 82. Flags:	
M. Homer & Son	*82 00
Horstman Bros. & Co.	97 80
Moses Briggs	92 00

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* Accepted.

Offers for furnishing materials for the League Island navy-yard, under advertisement dated January 12, 1877.

4,000 fire-brick:	
J. E. Mitchell	$190 00
Theo. Alexander	*150 00
A. W. Rand	220 00
300 pounds rivets, 500 pounds cut nails, 10 papers gimp-tacks, and 10 gallons japan-dryer:	
Noblit, Brown, Noblit & Co.	*58 55
J. B. Shannon	$61 00
Paul J. Field	60 70
Field & Hardie	58 65
170 pounds tire steel and 100 tire bolts:	
Midvale Steel Works	17 80
J. B. Shannon	19 78
Paul J. Field	*14 85
Morris Wheeler & Co.	15 10

Offers for furnishing materials for the League Island navy-yard, under advertisement dated February 7, 1877.

Class No. 1. Lumber:	
J. F. Quigley	$2,424 50
J. W. Gaskill & Sons	*2,222 25
Maule, Bro. & Co	2,840 00
Class No. 2. Lumber:	
J. F. Quigley	736 00
J. W. Gaskill & Sons	*609 50
Class No. 3. Bricks:	
J. & I. Gillespie	4,999 00
Benjamin Allen	$5,586 00
Excelsior Brick Company	*4,329 00
Class No. 4. Cement, &c.:	
United States White Lead Company	*1,282 85
Benjamin Allen	†1,261 00
P. J. Field	1,298 45
E. A. Smith & Son	1,301 80
Leslie & Trinkle	1,314 00

Offers for furnishing iron roof-frame, cornices, and dormers, and cornices, for the navy-yard at League Island, Pa., under advertisement dated March 1, 1877.

IRON ROOF-FRAME.

For steam-engineering, storehouse No. 4:	
Leighton Bridge and Iron Works	$13,075 00
Keystone Bridge Company	11,283 00
Edge Moor Iron Company	12,748 00
Passaic Rolling Mill Company	9,980 00
L. Sykes & Son	*$9,269 96
Iron City Bridge-Works.	16,900 00
William B. Scaife & Sons	12,495 00
Phœnix Iron Company	10,334 57
Philadelphia Architectural Iron Company	9,957 26
Birdsall Cornell	12,671 00
Nathaniel Cheney	11,882 00

GALVANIZED-IRON CORNICES, DORMERS, ETC.

For steam-engineering, storehouse No. 4:	
Philadelphia Architectural Iron Company	*$2,481 11
Louis Fischer	5,491 12
Kressler & Brand	4,236 34
Nathaniel Cheney	7,427 79
Kittredge Cornice and Ornamental Company	3,403 14
John F. Starr, jr.	$5,406 22
Marshall Bros. & Co.	3,794 68
John Siddons	3,105 89
Indianapolis Cornice Works	3,259 43
Stevenson & Cartwright.	4,003 79
Patterson & Bro	3,964 10
D. W. Stockstill & Co.	6,096 37

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* Accepted. † Rejected.

GALVANIZED-IRON CORNICES.

For storage and mould-loft building No. 7:	
Philadelphia Architectural Iron Company	*$1,017 89
Louis Fischer	1,546 80
Kressler & Brand	1,782 20
Nathl. Cheney	3,349 69
Kittredge Cornice and Ornamental Company	1,308 87
John F. Starr, jr	$2,111 60
Marshall Bros. & Co	1,353 40
John Siddons	1,161 62
Indianapolis Cornice Works	1,460 00
Stevenson & Cartwright	1,594 00
Patterson & Bro	1,484 25
D. W. Stockstill & Co	2,770 45

We certify that the above proposals were opened in our presence, that the scale is correct, and the contracts have been awarded to the lowest bidders according to the advertisement.

J. C. HOWELL,
Chief of Bureau.
WM. P. S. SANGER,
Civil Engineer of Bureau.
A. E. MERRITT,
Chief Clerk.
D. J. PARTELLO,
Clerk of Class 4.

BUREAU OF YARDS AND DOCKS,
March 31, 1877.

Offers for supplying navy-yard, Portsmouth, N. H., under advertisement dated April 2, 1877, for fifty tons coal, white-ash.

	Per ton.
Anthracite, steamboat size:	
E. F. Sise & Co	*$4 98
Russell and Odion	5 50
C. E. Walker & Co	$5 70
Howard Snelling & Co	8 00

Offers for furnishing materials, &c., for the League Island navy-yard, under advertisement dated 4th April, 1877.

7,440 feet spruce joists, 20 feet long:	
J. & C. Stockham	$163 68
E. B. Edwards & Co	204 60
J. W. Gaskill & Son	*162 94
23,430 feet spruce joists, 22 feet long:	
J. & C. Stockham	515 46
E. B. Edwards & Co	$644 32
J. W. Gaskill & Son	*513 12
7,200 feet spruce joists, 24 feet long:	
J. & C. Stockham	158 40
E. B. Edwards & Co	198 00
J. W. Gaskill & Son	*157 68

Offers for furnishing materials, &c., for the Portsmouth, N. H., navy-yard, under advertisement dated April 4, 1877.

20,000 feet bridge-plank, 4-inch:	
Samuel Adams & Co	*$360 00
E. H. Jewett	400 00
G. A. Hammond	458 00
Pitch and tar:	
Rider & Catton	*32 70
George T. Vaughan	34 20
Malleable-iron pipes and valves:	
Rider & Cotton	*$47 91
John P. Sweetser	51 99
Isaiah Wilson	90 44
Sheet-zinc, sash-cord, paints, &c.:	
John H. Bailey	*96 90
Rider and Cotton	97 50
Isaiah Wilson	105 75
A. T. Wendell & Co	109 55

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* Accepted.

Offers for furnishing materials, &c., for the Portsmouth, N. H., navy-yard, under advertisement dated April 9, 1877.

Upholstering-goods:	
C. Dwight Hanscom & Co	*$151 85
Fletcher & Tanton	167 92
E. M. Brown & Co	186 90
Ayers & Docke	152 15
Tacks, brushes, padlocks, &c.:	
John H. Bailey	*52 37
A. T. Wendell & Co	55 34
Isaiah Wilson	57 67
Rider & Cotton	54 59
Lava tips, kettles, and pans:	
John P. Sweetser	*$7 05
Rider & Cotton	8 75
Sperm-oil:	
Rider & Cotton	*72 45
G. T. Vaughan	72 68
N. F. Mathes	73 60

Offers for furnishing supplies for the League Island navy-yard, required under advertisement dated April 23, 1877.

Class No. 4. Yellow-pine lumber:	
A. A. McCullough	*$701 50
Austin P. Brown	746 00
J. W. Gaskill & Sons	748 00
Class No. 6. White-pine lumber:	
A. A. McCullough	5,543 35
Austin P. Brown	5,812 55
J. W. Gaskill & Sons	5,376 94
John F. Quigley	*5,097 82
Class No. 9. Sand:	
Austin P. Brown	*119 00
Class No. 10. Slate:	
Wilson & Miller	3,270 22
A. A. McCullough	2,777 25
J. G. Millspaugh	2,591 69
George P. Goff	2,563 44
Austin P. Brown	2,806 35
Peach Bottom Slate Mining Company	2,965 55
James J. Walton	‡295 38
Isaac Parker, jr	*2,392 93
Class No. 11. Iron, iron nails, and spikes:	
Paul J. Field	$952 50
J. G. Millspaugh	958 80
George P. Goff	1,000 20
Austin P. Brown	897 10
J. W. Gaskill & Sons	892 90
Charles J. Field	$909 60
J. B. Shannon	*864 63
Noblit, Brown & Co	945 80
Class No. 15. Paints, oils, and glass:	
William F. Simes & Sons	1,785 10
George P. Goff	1,694 47
Austin P. Brown	*1,404 94
J. W. Gaskill & Sons	1,572 14
United States Lead Company	1,693 23
J. B. Shannon	1,770 09
Class No. 17. Hardware:	
Paul J. Field	3,348 80
J. G. Millspaugh	3,443 82
George P. Goff	3,277 79
Austin P. Brown	3,334 15
J. W. Gaskill & Sons	*2,023 14
J. D. Rowland	3,658 95
Charles J. Field	2,583 34
J. B. Shannon	3,062 91
Noblit, Brown & Co	3,310 82
Jos. J. Walton	†1,260 00
Class No. 25. Iron-work, cast-iron columns &c.:	
Birdsall Cornell	6,260 96
Austin P. Brown	*5,448 00
J. D. Rowland	6,892 80
S. J. Creswell, jr	6,300 00
D. S. Creswell	6,462 00
Philadelphia Architectural Iron Co	5,600 00

We certify that the above proposals were opened in our presence, that the above scale is correct, and that the contracts were awarded to the lowest bidder, according to the advertisement.

J. C. HOWELL,
Chief of Bureau of Yards and Docks.
W. P. S. SANGER,
Civil Engineer of Bureau.
A. E. MERRITT,
Chief Clerk of Bureau.
D. J. PARTELLO,
Clerk of Class Four.

BUREAU OF YARDS AND DOCKS,
May 8, 1877.

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* Accepted. † Erroneous. ‡ Informal.

Offers for furnishing articles required on requisition No. 44 for Naval Asylum under advertisement dated June 11, 1877.

Mattresses and pillows:	
Noblit, Brown, Noblit & Co	*$156 00
W. Bascome	165 00
Lockers and tables:	
Robertson & Bryan	*129 00
Oil-cloth:	
McCallum, Crease & Straw per yard	110
J. F. & E. B. Orne & Co., per yard	*1 00
Reeve L. Knight & Co., per yard	1 40

Offers for furnishing provender, required for Washington navy-yard under advertisement dated June 28, 1877.

30 tons hay, 5 tons straw, 25,000 pounds corn-meal, 500 bushels oats, and 500 bushels shorts:	
G. Z. Raub	†$40 30
John A. Baker	$1,485 90
O. E. Hine	*1,420 00
J. D. Cumming	1,809 23
A. E. Phillips	1,613 50

Offers for furnishing beef, groceries, and bread required for the Naval Asylum, Philadelphia under advertisement dated June 26, 1877, on requisitions Nos. 1, 2, and 3.

Requisition No. 1, beef, &c.:	
G. Scheidt	$1,134 50
Henry Jahke	*983 00
Requisition No. 2, groceries:	
Anderson & Dunlap	667 90
Requisition No. 2, groceries—Continued.	
S. Hill	$643 45
R. McKeon	*620 75
Requisition No. 3, bread:	
J. McIlwain	*220 00

Offers for furnishing Georgia heart-pine timber, required for the Washington navy-yard, under advertisement dated June 27, 1877.

Georgia heart-pine timber:	
Smith & Wimsatt	$34 50 per M.
W. W. McCullough	*$29 00 per M
Thos. W. Smith	33 00 " "

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*Accepted.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, by the Bureau of Yards and Docks, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1879.
SALARIES.		
Chief clerk, per act July 5, 1862	$1,800 00	$1,800 00
Draughtsman and clerk of class 4, per act of March 7, 1867	1,800 00	1,800 00
One clerk of class 4, per act of March 7, 1867	1,800 00	1,800 00
Two clerks of class 3, per act of March 7, 1867	3,200 00	3,200 00
One clerk of class 2, per act of March 7, 1867	1,400 00	1,400 00
One clerk of class 1, per act of March 7, 1867	1,200 00	1,200 00
One messenger, per acts of July 5, 1862 and July 12, 1870	840 00	840 00
One laborer, per acts of July 5, 1862, and July 12, 1870	720 00	720 00
	12,760 00	12,760 00
CONTINGENT EXPENSES.		
Stationery, books, plans, drawings, incidental labor, and miscellaneous items.	800 00	800 00
FOR GENERAL MAINTENANCE.		
For general maintenance of yards and docks, freights and transportation of materials and stores; books, maps, models, and drawings; purchase and repair of fire-engines; machinery and patent right to use the same; repairs of steam-engines and attendance on the same; purchase and maintenance of oxen, horses, and driving teams; carts and timber-wheels for navy-yard purposes; tools and repairs of the same; postage on letters and other mailable matter on public service, and telegram; furniture for government houses and offices in navy-yards, coal and other fuel, candles, oil, and gas; cleaning and clearing up yards and care of public buildings; attendance on fires, lights, fire-engines and apparatus; for clerical and incidental labor at navy-yards; water-tax; tolls and ferriages; pay of watchmen in navy-yards; awnings and packing-boxes for yards and docks purposes	574,605 00	440,000 00
CONTINGENT.		
For contingent expenses that may arise at navy-yards and stations	25,000 00	20,000 00
NAVAL ASYLUM.		
One superintendent	600 00	600 00
One steward	480 00	480 00
One matron	360 00	360 00
One cook	240 00	240 00
Two assistant cooks, at $168 each	336 00	168 00
One chief laundress	192 00	192 00
Four laundresses, at $168 each	672 00	504 00
Eight scrubbers and waiters, at $168 each	1,344 00	1,344 00
Six laborers, at $240 each	1,440 00	1,440 00
One stable-keeper and driver	360 00	360 00
One master-at-arms	480 00	480 00
One corporal	300 00	300 00
One barber	360 00	360 00
One carpenter	845 00	845 00
For water-rent and gas	2,000 00	1,800 00
For cemetery, burial expenses, and head-stones	350 00	350 00
For improvement of grounds	700 00	1,000 00
For painting of walls	550 00	....
For furniture and repairs of the same	1,750 00	500 00
For repairs to buildings, furnaces, grates, &c	5,400 00	300 00
For ice, car-tickets, &c	450 00	250 00
For support of beneficiaries	45,225 00	40,000 00
	64,434 00	51,873 00

Estimates of appropriations required for the service of the fiscal year, &c.—Continued.

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
NAVY-YARD, PORTSMOUTH, N. H.		
Repairs and preservation	$39,000 00	$150,000 00
NAVY-YARD, BOSTON, MASS.		
Repairs and preservation	90,000 00	
NAVY-YARD, NEW LONDON, CONN.		
Repairs and preservation	2,550 00	
NAVY-YARD, NEW YORK, N. Y.		
Repairs and preservation	100,000 00	
NAVY-YARD, LEAGUE ISLAND, PA.		
Repairs and preservation	40,000 00	
NAVY-YARD, WASHINGTON, D. C.		
Repairs and preservation	90,000 00	
NAVY-YARD, NORFOLK, VA.		
Repairs and preservation	90,000 00	
NAVY-YARD, PENSACOLA, FLA.		
Repairs and preservation	80,000 00	
NAVY-YARD, MARE ISLAND, CAL.		
Repairs and preservation	100,000 00	
NAVAL STATION, SACKETT'S HARBOR, N. Y.		
Repairs and preservation	2,000 00	
NAVAL STATION, KEY WEST, FLA.		
Repairs and preservation	13,600 00	
	647,150 00	150,000 00
NAVY-YARD, PORTSMOUTH, N. H.		
Repairs of dry-dock	9,000 00	....
Paving, gutters and drains	5,000 00	....
Water-works	3,000 00	....
Timber-shed	30,000 00	....
	47,000 00	....
NAVY-YARD, BOSTON, MASS.		
Boundary-wall	10,000 00	....
Cart-shed	10,000 00	....
Yards and docks, work-shops	50,000 00	....
Paving and grading and extension of railway facilities	15,000 00	....
New floor at rope-walk	18,869 00	....
	103,869 00	....
NAVY-YARD, NEW YORK, N. Y.		
Timber-shed	50,000 00	....
Coal-depot	20,000 00	....
Retaining crib-work	30,000 00	....
Fire-engine house	7,000 00	....
	107,000 00	....
NAVY-YARD, LEAGUE ISLAND, PA.		
For commencing quay-wall on Delaware front	60,000 00	....
For commencing floating-dock basin	255,000 00	....

Estimates of appropriations required for the service of the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1877.
NAVY-YARD, LEAGUE ISLAND, PA.—Continued.		
Dredging and filling in	$50,000 00	
Yard buildings	75,000 00	
Water, gas, and sewerage	30,000 00	
Grading, graveling, and paving	20,000 00	
Embankments (temporary)	5,000 00	
Roads and rail-tracks	5,000 00	
	500,000 00	
NAVY-YARD, NORFOLK, VA.		
Timber-shed No. 32	35,000 00	
Timber-shed No. 33	35,000 00	
Chain and cordage store No. 12	20,000 00	
Railroad and engine-house	15,000 00	
Extension of quay-wall	20,000 00	
	125,000 00	
NAVY-YARD, PENSACOLA, FLA.		
Timber-shed No. 11	38,356 00	
Steam engineering machine-shop	86,644 00	
	125,000 00	
NAVY-YARD, MARE ISLAND, CAL.		
For continuation of dry-dock	400,000 00	
For removal of gas-holder and gas-works	6,750 00	
For completing water-mains and service-pipes from reservoir	27,462 00	
For roads and pavements and railways	25,000 00	
For extension of timber-shed No. 94	20,000 00	
For dredging and scowing	100,000 00	
For quay-wall and wharves	50,000 00	
	629,212 00	
NAVAL STATION, KEY WEST, FLA.		
For building wharf	30,000 00	
NAVY-YARD, PORTSMOUTH, N. H.		
One clerk	1,400 00	
One clerk	1,300 00	
One writer	1,017 75	
One mail-messenger	700 00	
	4,417 75	
NAVY-YARD, BOSTON, MASS.		
One clerk	1,400 00	
One clerk	1,300 00	
One writer	1,017 75	
One mail-messenger	700 00	
	4,417 75	
NAVAL STATION, NEW LONDON, CONN.		
One writer	1,017 25	
NAVY-YARD, BROOKLYN, N. Y.		
One clerk	1,400 00	
One clerk	1,300 00	
One writer	1,017 25	
One writer	939 00	
One mail-messenger	700 00	
One draughtsman	1,565 00	
	6,921 25	

Estimate of appropriations required for the service of the fiscal year, &c.—Continued.

Detailed objects of expenditure and explanation.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1877.
NAVY-YARD, LEAGUE ISLAND, PA.		
One clerk	$1,400 00	....
One clerk	1,300 00	....
One writer	1,017 25	....
One writer	939 00	....
One mail-messenger	700 00	....
One draughtsman	1,565 00	....
	6,921 25	....
NAVY-YARD, WASHINGTON, D. C.		
One clerk	1,400 00	....
One clerk	1,300 00	....
One writer	1,017 75	....
One mail-messenger	700 00	....
	4,417 75	....
NAVY-YARD, NORFOLK, VA.		
One clerk	1,400 00	....
One clerk	1,300 00	....
One writer	1,017 25	....
One writer	939 00	....
One mail-messenger	700 00	....
	5,356 25	....
NAVY-YARD, PENSACOLA, FLA.		
One clerk	1,400 00	....
One writer	1,017 25	....
	2,417 25	....
NAVY-YARD, MARE ISLAND, CAL.		
One clerk	1,400 00	....
One clerk	1,300 00	....
One writer	1,017 25	....
One writer	939 00	....
One mail-messenger	700 00	....
One draughtsman	1,565 00	....
	6,921 25	$42,807 75

NO. 4. BUREAU OF NAVIGATION.

NAVY DEPARTMENT, BUREAU OF NAVIGATION,
October 30, 1877.

SIR: I have the honor to submit the following report of the Bureau of Navigation for the past year, together with the estimates for its support, and for the expenditures that will probably be required in that division of the naval service committed to its immediate charge, for the fiscal year ending June 30, 1879. Included in this report and transmitted herewith are the reports and estimates of the several offices under its cognizance, and an abstract of offers for supplies received.

NAVIGATION.

The Navy is now fairly supplied with the new liquid compass for any ordinary contingency of increase of force afloat. The best dry compasses have been retained for use, should any extraordinary exigency arise.

Your attention is called to the appended report of Prof. B. F. Greene, who is charged with the superintendence of compasses and of other magnetic matters in the Navy. His views and recommendations relative to magnetic surveys are fully approved by this bureau, having a special fitness at the present time.

The Navy has hitherto done very little, relatively, in making magnetic observations of the class referred to by Professor Greene. It seems but right, to say the least, that we should perform a proportional part of this service, one that has been hitherto mainly performed by other navies, and which, in the nature of things, can only be properly done by national vessels. The results, as a whole, are for the common benefit of all who may derive advantage from the promotion of nautical science and the improvement of nautical methods.

With your approval this bureau purposes to have all of our ships on special cruises, as well as many of those attached to foreign stations, take a part in the work of collecting such data, by magnetic observations, as shall be found most suitable to the object in view, both at sea and in port; the data thus collected to be periodically forwarded to this bureau in the manner of other similar returns. The duty each day will not be an arduous one, and, if carried out in a systematic manner, will result in a large aggregate of useful data for the improvement of our magnetic charts.

The requisite instruments for supplying all of our vessels-of-war to make these observations in the best manner would require too heavy an expenditure to be borne by the ordinary annual appropriation for instruments. A sufficient number of them will be obtained to commence fairly, and, if required, additional appropriations will be asked next year to supply in full all of the instruments found best adapted to effect the work with the necessary precision.

This bureau has now 108 condemned box-chronometers, which cannot be sold at auction without the risk of their being purchased for use at sea by merchant vessels, and should this occur many losses by shipwreck would result. It is respectfully suggested that authority be given to this bureau to sell a given number of them at a nominal price of, say, twenty dollars each, to such institutions of learning as may wish them, and would guarantee their employment at the institutions only.

HYDROGRAPHY, CHARTS, AND BOOKS.

The Hydrographic Office is now able to supply most of the charts required by our commercial marine, and is extending its publications as the appropriations will warrant, substituting engraved charts for those produced by photolithography. The report of the Hydrographer, herewith appended, states satisfactorily and in detail the work in progress.

The telegraphic longitudes determined by Lieutenant Commander F. M. Green, and other accurate observations in the West Indies, were completed last year as far as facilities existed. The results are entirely satisfactory, and are now published.

With a view of contributing to the safety of navigation, the department has assigned the store-ship Guard to determine longitudes telegraphically between Lisbon, Madeira, Cape de Verde Islands, and Pernambuco, thence extending south to Buenos Ayres and to the west coast of South America. Upon the completion of that labor Pernambuco and the island of Trinidad will be joined telegraphically, thus completing a double determination, and confirming both lines at the island of Trinidad.

The United States Steamer Huron, Commander G. P. Ryan, commanding, has been advantageously employed in carrying chronometer longitudes from the island of Trinidad along the northern coast of South America, and in making surveys where found necessary; she is now fitting out, under your instructions, to resume this work at the proper season on the south side of the island of Cuba, and such other localities in the West Indies as may be designated by the Hydrographer.

The United States Steamer Gettysburg, Lieut. Commander H. H. Gorringe, commanding, is now most usefully employed in collating information and making surveys to facilitate navigation in the Mediterranean Sea. In making the voyage from the United States, Lieutenant-Commander Gorringe had the satisfaction of discovering a bank in the open ocean, about one hundred and thirty miles from Cape St. Vincent, the shoalest known part of which has thirty-two fathoms of water. A second examination was made by him without obtaining further results, except more extended soundings. This bank has since been surveyed by Her Britannic Majesty's Ship Salamis, without finding shoaler water.

The United States Steamer Essex is now engaged, under your instructions, in making a series of deep-sea soundings between the United States and the coast of Africa, and thence via St. Helena to the coast of Brazil.

The United States Steamers Adams and Frolic were engaged, under your orders, in looking up the Madeiros Rock and Hotspur Bank, on the coast of Brazil, without further success than the discovery of another bank. The search, however, was not sufficient to warrant eliminating the dangers sought.

No special appropriations have been made for any of the above surveys. Whatever special instruments have been required in the prosecution of these works have been purchased from the funds of this bureau.

For a series of years this bureau has endeavored, without success, to obtain appropriations for the purpose of purchasing or building suitable vessels for making a survey of the North Pacific Ocean.

These vessels would serve the purpose of vessels-of-war among the islands, and, under instructions, could proceed wherever irregularities existed, as has been the case recently under our flag in the South Pacific.

It is quite within the bounds of probability that, had these vessels been appropriated for when first asked, the Pacific Mail Steamer City of San Francisco would not have been lost near what is known as the Tartar Shoal, eighty-five miles east-south-east of Acapulco. An English steamer has also been lost on Fanning's Reef, lying in the North Pacific Ocean, within this time, and doubtless other vessels, due to a want of proper geographical location of dangers and of knowledge of the currents of that ocean.

These losses will not only continue but increase in number as long as the same lack of geographical knowledge exists in those seas. In my report of 1875, the following appears: "The survey of the North Pacific Ocean is a necessity; without it the loss of life and property will yearly increase; and as the ocean binds our coasts, it should be our pride, as it is our interest, to lessen the dangers of its navigation as much as possible," which unhappily has been verified, and will continue to be until the necessary surveys are made.

No appropriations have yet been made for publishing the careful instrumental survey of the Isthmus of Panama made by Commander E. P. Lull, United States Navy, assisted by Civil Engineer A. G. Menocal and a party of naval officers; nor for publishing the instrumental location of an inter-oceanic ship-canal by Lieut. F. Collins, United States

Navy, and naval officers under his command, along what is known as the Atrato-Napipi route.

Although perhaps comparatively small value may be attached to these surveys in a practical point of view, they are well executed and in every way worthy of publication. They reflect great credit on the officers commanding the parties, as well as their subordinates.

SIGNALS.

For the past four years, under the more immediate charge of the Chief Signal Officer, whose appended report will be read with interest, this bureau has endeavored to improve night and fog signaling, and feels assured of the progress made.

A system of projecting stars to a considerable height, usually known as "Roman candles," of two colors, was given in an official report by Lieut. E. W. Very, United States Navy, to the Chief Signal Officer in August, 1874, but, not having been acted on by him, nor brought to the knowledge of this bureau, laid dormant until recently. It promises many advantages over any system of night-signaling now in use by us.

A "siren" for sounding course-signals automatically, as well as for other use, was designed and made by Messrs. A. & F. Brown, of New York, at the instance of this bureau. By means of brakes, air is compressed and either made to escape automatically, whistling with precision combinations of sounds indicating the course steered *within one point* or less; or the automatic arrangement is detached and the instrument used orally, as flags are used visually, in spelling out what may be desired, or, conventionally, in any other manner agreed upon. It supplies what nothing else will to the same degree, namely: a ready and reliable means of communicating intelligence in fogs, at least within distances where collision is imminent.

Two sirens have been made, the first with a single note, the second having two, differing in tone. It is proposed to designate automatically each of the four quadrants by notes, as well as the course steered, within one point or less, by another tone.

Without wishing in any degree to be officious as regards the merchant marine and its fitments, it seems proper for this bureau to indicate for examination or to give publicity to whatever seems likely to advance either the safety or other interests of the commercial marine.

The electric light shows promising advance; little more seems necessary to establish its use on board of vessels-of-war. It is too expensive still for ordinary use in time of peace, but would be considered indispensable to efficiency in time of war. It possesses the utmost capacity for signaling. The rays can be projected on the clouds, or they appear like a great arm of light moving to the right or left, the combinations in movement being all that is necessary for distinct signaling at great distances.

This bureau has invited a proposal for an electric machine of 3,000 candle-power, with the enginery, lamp, &c. If the amount asked for its construction is reasonable, the question will be considered.

SIMULTANEOUS METEOROLOGICAL OBSERVATIONS.

At the request of General A. J. Meyer, Chief Signal Officer of the Army, the department directed the co-operation of all of our vessels-of-war and naval stations, which order has gone into operation as far as possible with the present instruments loaned by the Army Signal Office. To properly effect the object, however, a small annual appropriation now asked for will be necessary.

NAVAL OBSERVATORY AND NAUTICAL ALMANAC.

The report of the Superintendent of Naval Observatory will doubtless receive the careful consideration which it merits, and the report of the Superintendent of the Nautical Almanac gives the information as to what is necessary to increase the usefulness of that work, and to secure its preparation for publication.

OFFICE OF DETAIL.

It is proper to add that the Navy, by request of the Treasury Department, and under existing laws and usage, has detailed eighteen officers upon light-house duty, principally as inspectors, and forty-seven for service in the United States Coast Survey, which affords a most useful employment, and highly advantageous in promoting the professional status of the officers.

It furnishes also eight officers, authorized by special act, for school-ships for the cities of New York and San Francisco.

The maintenance of these officers, usefully and properly employed in furtherance of other departments of the government, is nevertheless borne by naval appropriations; it is worth while to state the fact, as so considerable a number of officers are performing other functions than naval duty, yet supported from naval appropriations.

Respectfully submitted.

DANIEL AMMEN,
Chief Bureau Navigation.

HON. RICHARD W. THOMPSON,
Secretary of the Navy.

OFFICE OF SUPERINTENDENT OF COMPASSES,
BUREAU OF NAVIGATION,
Washington, October 20, 1877.

SIR: I have the honor to submit herewith the following report for the current year.

THE NAVY COMPASS.

Relative to the compass itself, I have nothing to report beyond the renewed statement of its continued excellence as shown by the routine tests of inspection at the compass observatory. Some recent suggestions have been presented by the maker of the Azimuth Circle (used upon the Navy compass) looking to the substitution of a fixed prismatic reflector for the lower black glass reflector of this instrument. The idea is a good one in several particulars, as promising a much better illumination with a more simple and more stable construction, if it can be realized without special disadvantage. It is also proposed to have all the prisms, both eye and object, so mounted as to be readily removable for more thorough cleaning, and as readily replaceable, without risk of appreciable derangement of their adjusted positions. A circle embodying these suggestions is being prepared for examination and trial.

Under the head of Compass Inspection, and that of the Magnetism of Ships and Compass Deviation, I have nothing special to report at this time in addition to the usual routine service. I beg, however, to present certain considerations bearing upon another subject, intimately connected with that last mentioned, upon which I have had the honor of several informal conversations with you during the past year, which seems to me of sufficient importance to demand our earliest attention.

MAGNETIC SURVEYS.

The discrepancies frequently found between the results obtained from careful observations of the magnetic variation and those deduced by applying the assigned secular change to the variation given by our magnetic charts, even upon the frequented tracks of commerce, are sufficient to show that errors in the use of this most important aid to navigation are liable to occur, either from inaccurate epochal values or from erroneous assumptions as to the secular change, or from both combined.

With such an experience, magneticians have no reason to be greatly surprised. Even in regarding the original determinations of this element as sufficiently accurate, they were neither sufficiently numerous nor sufficiently well distributed to give to the chart constructions a precision at all points equal to that of the observations themselves. But, in reality, the presumption of the general accuracy of these determinations cannot be admitted; for, besides having been derived from observations at various antecedent dates, extending over many years, and therefore liable to considerable uncertainties with every attempt at reduction to a common epoch, the determinations from sea observations, at the least, were subject to defects from various sources in the circumstances of the observation. If, then, in addition to the probable uncertainties of the values actually given upon the chart at the epoch of its formation, we take into consideration the difficulties which attend the correct estimate of the annual or secular change, commonly more than a tenth of a degree, but varying in different places and at different times in the same place, it may not be difficult to see that at the best the accuracy of our magnetic charts and tables must be accepted with considerable qualification. In all this there is no intention to depreciate the value of these helps to the navigator. Even with their acknowledged imperfections they are believed to be generally reliable within limits that make them indispensable to him. Moreover, they are probably not only the best that could be had from the data available for their construction, but the data themselves are perhaps as reliable as could be expected from the circumstances of their origin.

Reference has been made more particularly to the magnetic variation, which, in view of its relatively greater importance in the ordinary reductions of the navigator, is more immediately appreciated by him; but the general bearing of what has already been said applies with equal force to the other two elements of terrestrial magnetism, namely, the magnetic dip and horizontal intensity, the important uses of which are becoming more and more manifest in these later times to intelligent navigators in many of the practical problems which concern the judicious management of our iron ships.

It must therefore be tolerably evident that, in order to perfect our magnetic charts and tables, and to make them in the highest sense reliable and satisfactory for practical use, the necessity exists for a continual extension and renewal of magnetic observations for many years to come; or, at the least, until, first, a sufficient number of well-distributed and carefully-observed determinations of all the magnetic elements shall have been made in addition to those already obtained; and, secondly, such opportunities shall have been furnished for general discussion of the elements obtained at different epochs, as shall suffice for *reliable values of the annual change*, which, it may be repeated, is at present the desideratum, and which can only be had by means of *sufficient data at different epochs.*

The observations at sea, which furnish by far the larger number of magnetic determinations at well-separated independent positions, have hitherto been and must continue to be mainly made by the naval officers of the several maritime governments. Even at numerous stations on shore, serving as bases for the observations made at sea, as well as from often being less conveniently accessible to other observers, the work must be done principally by naval officers. As is well known, systematic observations for the three elements of terrestrial magnetism have been made by the British navy for many years past; these observations forming a part of the daily routine on board of all sea-going ships; and it is due to that service to say that, but for the appreciation and foresight of the British Admiralty in providing the requisite facilities, and the persevering zeal of British naval officers in this class of observations, we should not have had sufficient materials up to the present time for the construction of a tolerable magnetic chart, even of the variation alone.*

Unfortunately, we cannot say much in relation to the work hitherto performed by our service in this field. With the exception of an occasional naval expedition, when magnetic observations formed a part of the scientific duty on board, we can hardly claim to have done anything toward observing for the three magnetic elements; the most which has been done by our ships on general service, consisting of occasional determinations of the magnetic variation. Even these observations, as made on board ship, have too rarely been accompanied by the requisite care in the treatment of the associated observation, instrumental, and deviation errors, to permit much reliable use to be made of them in chart-making. But these shortcomings, if they may be so called, do not appear to be properly chargeable to the naval officers themselves, so much as to various circumstances more or less outside of their control, which need not now be particularized. It is undoubtedly sufficient to recognize our duty at the present time, and, if we may, to make amends for past deficiencies. And surely, in view of the important benefits to navigation to be derived from the possession of a complete system of accurate magnetic charts or tables, there is no reason for doubt that the officers of the United States Navy will be found both ready and desirous, if furnished with suitable facilities, to render at the least their proportional meed of service toward the accomplishment of this object. Incidentally, also, it will not, perhaps, be forgotten that there is a higher plane from which to look at this subject than that of the merely economic or practical, however important in itself; and this is, the possibility of contributing some acceptable data as material for the use of the magnetician, in those theoretical discussions which not only conduce to the advancement of science, but, with every step of progress, are also certain to react more or less quickly in the improvement of the means and processes of useful application.

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* It is true that magnetic charts of all the elements were constructed by GAUSS upon the basis of the few observations then available (about forty years ago), with the aid of his general theory of terrestrial magnetism, which represented with remarkable accuracy the few facts of observation. But although he thus established the complete success of that celebrated investigation, yet, admirable as it was from every point of view, it was not expected, and certainly not by him, that its results should supersede the necessity of further observation. On the contrary, it was only expected that it might serve as a useful auxiliary to the results of actual observation, in supplying data for places where observations were wanting and necessary to an equalized distribution of the data in the construction lines of a chart. Beyond that such a theory could not be expected to go, as its own constant elements must depend on the accuracy, number, and distribution of the data derived solely from observation.

The magnetic observations which would be contributed by the Navy consist, in part, of those made on shore at the usual ports of outfit and of subsequent entry, and occasionally (as found expedient) at intermediate landings, these stations serving as bases for the much larger part of the observations made on board at sea. The observations on shore need to be made with every practicable care and attention to precision of results, those for intensity being absolute determinations; while the observations on board, made at determined positions on each track from one base to another, necessarily require correction for the magnetic action of the ship, those for the intensity being in this case only relative determinations; all the observations for each track being brought by subsequent reduction into co-ordinate relation to those of the bases at its extremities.

For these observations certain instruments and fittings will be required in addition to the usual outfit now put on board. The expense of such extra equipment will be moderate, in reality bearing only a very small part to that of the whole outfit of instruments issued to the navigation department. Even the whole of this expense need not be incurred at first; but a certain number of sets of apparatus might be provided, say sufficient to supply the outfitting ships of one year; or, so as to give to each its complement of instruments for this service, when otherwise equipping for a foreign station or for a special cruise, and at the same time to provide for the requisite preliminary base observations at the port of outfit.

The resulting observations, arranged upon printed forms, with all the data, direct or otherwise, relating to them, should be periodically forwarded to the Bureau of Navigation with as much frequency as may be found practicable, in order that timely examinations may be made, and any suggestions bearing upon a particular case promptly sent forward to the ship.

I am, sir, very respectfully, your obedient servant,

B. F. GREENE,

Professor of Mathematics, U. S. N., Superintendent of Compasses.

Commodore DANIEL AMMEN, U. S. N.,
Chief of Bureau of Navigation, Navy Department.

Estimate of appropriations required for the service of the fiscal year ending June 30, 1879, by the Bureau of Navigation.

FOR THE SUPPORT OF THE BUREAU OF NAVIGATION.

For salary of chief clerk. (Revised Statutes, page 69, section 416, and act of August 15, 1876)	$1,800
For salary of one clerk of third class. (Revised Statutes, page 26, section 167, and act of August 15, 1876)	1,600
For salary of one clerk of second class. (Act of August 15, 1876)	1,400
For salary of messenger. (Act of August 15, 1876)	840
For salary of laborer. (Act of August 15, 1876)	720
For contingent expenses	800
Total	7,160

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, by the Bureau of Navigation.

A.

I.—FOR NAVIGATION.

For foreign and local pilotage and towage of ships of war	$55,000 00
For payment of canal-dues and other charges incidental to passing through canals (inapplicable to any other purpose)	7,000 00
For services and materials in correcting compasses on board ship, and for adjusting and testing compasses on shore	3,000 00
For nautical and astronomical instruments, nautical books, maps, charts, and sailing-directions and repairs of nautical instruments for ships of war	10,000 00
For instruments for taking simultaneous international meteorological observations on board ships of war	1,000 00
For books for libraries for ships of war	3,000 00
For navy signals and apparatus, namely: signal-lights, lanterns, rockets, including running-lights, drawings, and engravings for signal-books	6,000 00
For compass-fittings, including binnacles, tripods, and other appendages of ships' compasses	3,000 00
For logs and other appliances for measuring the ship's way, leads and other appliances for sounding	3,000 00
For lanterns and lamps and their appendages for general use on board ship, including those for the cabin, ward-room and steerage, for the hold and spirit-room, for decks and quartermasters' use	5,000 00
For bunting and other materials for flags and making and repairing flags of all kinds	5,000 00
For oil for ships of war, other than that used for the engineer department, for candles when used as a substitute for oil in binnacles, running-lights, for chimneys and wick, and for soap used in the navigation department	20,000 00
For stationery for commanders and navigators of vessels-of-war and for use of courts-martial	2,000 00
For musical instruments and music for vessels of war	1,000 00
For steering-signals and indicators, and for speaking-tubes and gongs for signal communication on board vessels-of-war	2,000 00
Total	126,000 00

II.—FOR NAVIGATION, CONTINGENT.

For freight and transportation, postage and telegraphing on public business, advertising for proposals, packing-boxes and materials, and all other contingent expenses	$3,000 00

III.—FOR NAVIGATION, CIVIL ESTABLISHMENT.

For civil establishment in the navigation departments of the several navy-yards, namely:

Portsmouth	$1,300 00
Boston	1,400 00
New York	1,400 00
League Island	1,300 00
Washington	1,400 00
Norfolk	1,300 00
Pensacola	1,017 25
Mare Island	1,300 00
Total	10,417 25

IV.—FOR NAVIGATION, HYDROGRAPHIC WORK.

For drawing, engraving, purchase of chart-paper, printing and reproducing charts; correcting plates; preparing and publishing sailing-directions and other hydrographic information	$50,000 00
For fuel, lights, and office furniture; care of building and other labor; purchase of books for library; drawing materials and other stationery; postage, freight, and other contingent expenses	5,000 00

For rent and repair of building	$2,800 00
For contingent expenses of the expedition for the determination of longitudes by electric cable, viz: for paying telegraphic operators; expenses of detention of parties on shore, and travel	2,500 00
Total	60,300 00

B.

I.—FOR NAVAL OBSERVATORY.

For three assistant astronomers: one at $1,500, during first five years; one at $1,800, during second five years; and one at $2,000, during third five years	$5,300 00
For one clerk	1,800 00
For one instrument-maker, three watchmen, one messenger, and one porter; keeping grounds in order; repairs of buildings and inclosures; fuel, light, and office-furniture; chemicals for batteries; stationery, freight, and all other contingent expenses	13,500 00

[NOTE.—The sum of $13,500 was for many years the amount annually appropriated. The reduced sum ($10,000) has proved inadequate to the maintenance of the establishment and the preservation of the buildings.]

For reducing and transcribing astronomical and meteorological observations for publication	3,600 00
For professional books for the library	1,500 00
For turning-lathe and attachments necessary for repairs of astronomical instruments and for general work; to replace the present lathe, which is thirty years old and worn out	800 00
Total	26,500 00

II.—FOR NAVAL OBSERVATORY, OBSERVATIONS OF TRANSIT OF VENUS.

For illustrations of volume of observations of Transit of Venus	$1,000 00

III.—FOR NAVAL OBSERVATORY, CATALOGUE OF STARS.

For completing catalogue of stars from observations made by Lieut. J. M. Gilliss, chief of United States Naval Astronomical Expedition to the southern hemisphere, in 1851 and 1852	$2,500 00

IV.—FOR NAVAL OBSERVATORY, OBSERVATIONS OF SOLAR ECLIPSE.

For observations of solar eclipse of July, 1878	$8,000 00

C.

I.—NAUTICAL ALMANAC.

For pay of computers and clerk preparing for publication the American Ephemeris and Nautical Almanac	$19,000 00
For rent, fuel, labor, stationery, boxes, expressage, books, and miscellaneous expenses	1,500 00
For ephemeris of new planets discovered by American astronomers	3,000 00
Total	$23,000 00

[NOTE.—The diminished appropriation of $15,000 has proved insufficient for the annual computations of the Almanac, which are falling behind.]

RECAPITULATION.

Estimate of appropriations required for the fiscal year ending June 30, 1879, *by the Bureau of Navigation, Navy Department.*

FOR SUPPORT OF BUREAU.

Salaries and contingent	$7,160 00

FOR THE NAVAL SERVICE.

A.	I.—Navigation	$126,000 00
	II.—Navigation, contingent	3,000 00
	III.—Navigation, civil establishment	10,417 25
	IV.—Navigation, hydrographic work	60,300 00
B.	I.—Naval Observatory	26,500 00
	II.—Naval Observatory, observations, transit of Venus	1,000 00
	III.—Naval Observatory, catalogue of stars	2,500 00
	IV.—Naval Observatory, observations of solar eclipse	8,000 00
C.	I.—Nautical Almanac	23,500 00
	Total	$261,217 25

ABSTRACT OF OFFERS FOR SUPPLIES RECEIVED FOR FURNISHING ARTICLES COMING UNDER THE COGNIZANCE OF THE BUREAU OF NAVIGATION.

Stationery.—Bureau's order of November 20, 1876.

Sears & Cole*	$1,447 95	Wilbur & Hastings	$1,545 20
W. H. Arthur & Co	1,480 90	Nathan Lane	1,701 70
Thomas & Hagar	1,503 77	Alexander Agar	1,735 28
E. A. Kingsland & Co	1,525 01		

Eight thousand gallons lard-oil.—Bureau's order of January 9, 1877.

Manhattan Oil Company,* per gallon	$0 97½	Wm. A. Cole & Co., per gallon	$0 98
		E. T. Howe, per gallon	98⅜

Ten thousand gallons lard-oil.—Bureau's order of July 27, 1877.

Manhattan Oil Company,* per gallon	$0 78¼	E. T. Howe, per gallon	$0 78⅜
		J. H. Walker, per gallon	79¼

Stationery.—Bureau's order of August 18, 1877.

Arthur & Bonnell*	$1,199 03	W. H. Dempsey	$1,308 25
Thomas & Hagar	1,229 72	P. W. Derham	1,334 27
Wilbur & Hastings	1,277 64	Sears & Cole	1,337 77
E. A. Kingsland & Co	1,305 67	Alexander Agar	1,680 66

UNITED STATES NAVAL OBSERVATORY,
Washington, October 23, 1877.

SIR: In compliance with the instructions of the Bureau of the 11th instant, I have the honor to submit a report of the operations of the Naval Observatory for the past year.

TRANSIT INSTRUMENT AND MURAL CIRCLE.

During the year Prof. M. Yarnall has been engaged in observing with the transit instrument and the mural circle, observing alternately with each instrument, such star-places as were deemed necessary to complete the catalogue of 1845–1871.

The methods of observation and reduction have been such as were used in past years, and it is hoped that a second and more perfect edition of this catalogue will be published in the course of the coming winter and spring. The catalogue embraces all the observations made in the observatory with the old instruments by all observers, and forms an epoch in the annals of the observatory. His time has been completely employed in these observations and in the reduction of the stars from the epoch of each year to that of 1860, the epoch of the catalogue. He has been assisted during the year by Lieut. E. W. Sturdy, whose valuable services he takes pleasure in acknowledging. Mr. D. P. Todd was kind enough to observe for him several evenings without special assignment.

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*Accepted.

MOTION OF THE MOON.

The work of Prof. Simon Newcomb on this subject, after suffering an interruption of some years, was recommenced in 1876. That part of it which consists of a new reduction and examination of all recorded eclipses and occultations of value before 1750 is substantially complete, the most of it being in the hands of the printer. The ancient observations, which have been considered most reliable, indicate a correction of more than half an hour to the times of ancient eclipses as hitherto calculated from the tables. This correction so changes the computed paths of the moon's shadow during total eclipses, that the chronological questions involved in them will no doubt have to be re-examined. The most remarkable result of the research is, that the motion of the moon during the past 250 years may be very closely represented by the alteration of a single term in Hansen's Tables. The question whether this alteration is admissible in the Theory cannot yet be decided.

TWENTY-SIX-INCH EQUATORIAL.—(In charge of Prof. Asaph Hall, with Prof. E. S. Holden as assistant.)

This instrument has been employed the past year in the observation of the satellites of Saturn, Uranus, and Neptune, in observing double stars, and several comets. The observations of these satellites and comets have been published in the Astronomische Nachrichten. As the satellites of Uranus and Neptune have now been observed for several years with this instrument, and tables of their motions have been computed, it does not seem worth while to continue the observations of these satellites at the present time. In the year 1882 the plane of the orbit of the satellites of Uranus will pass through the sun, and at that time the apparent orbit of the satellite of Neptune will have opened so much that this satellite can be observed with ease in all parts of its orbit. It seems better, therefore, to give up, until the year 1881, the observations of the satellites of these two planets. In that year another and complete series of observations of these systems should be undertaken with this instrument. The fainter satellites of Saturn should be followed with this instrument for several years; and the curious phenomena connected with the ball and ring of this planet are also worthy of careful observation.

The list of thirty double stars selected by Mr. Otto Struve, director of the Pulkowa Observatory, for the purpose of comparing the measures of different observers, has been observed by Professor Hall, and about two-thirds of the requisite number of observations have been made. This work will be finished during the next year.

The two satellites of Mars, discovered by Professor Hall in August, have been observed on nearly every clear night since their discovery, the date of the last observation being October 15, and the observations made at the Naval Observatory alone will give a good determination of their orbits. It seems now quite certain that these satellites will be visible again in October and November, 1879, and observations in that year will serve to fix their periods with accuracy.

This instrument is now in good working condition. Since the change in the bearing of the shaft of the driving-clock, made in July, 1876, the performance of the clock has been much better. It is doubtful if it be sufficiently steady for photographic or spectroscopic work, but it answers very well for micrometrical measurements.

The dome is now moved with considerable difficulty, probably on account of inequalities in the settling of the supporting walls. This should be remedied in some way.

During the next year, an equatorial telescope, having an aperture of 27 inches, will be mounted at Vienna; and the telescope made by Messrs. Alvan Clark & Sons for Mr. McCormick, and which is a little larger than ours, is ready for mounting. Under these circumstances, it is worth while to consider whether it would not be advaugeous to establish a branch observatory on some of the elevated plains in the central part of this country. It seems probable that a good location might be found between the parallels of thirty and thirty-five degrees of north latitude, near the projected line of the Southern Pacific Railroad. Should such a location be found, at an altitude of six or eight thousand feet, its advantages might more than compensate the increased size of other telescopes. A branch observatory could be established in such a locality, and our 26-inch equatorial could be mounted and used in such an observatory, for five or ten years, at no great increase of cost. Until some such thorough experiment be made, it is certain that the question of what is to be gained by observing at a station which is above a large part of our atmosphere will remain undecided.

A monograph on the central and brightest regions of the nebula of Orion is in preparation, and is now nearly completed, by Professor Holden. The observations on which this depends have been made with the 26-inch equatorial during the oppositions of 1874, 1875, 1876, and 1877, and will furnish data for determining the positions and boundaries of all the brighter nebulous masses. In connection with this, all previously published (and many unpublished) descriptions, drawings, and observations have been collected and studied, with the object of giving in one memoir a complete history of this nebula from its discovery in 1618 to 1878, a period of 260 years.

In order to present this evidence properly a series of wood-cuts or lithographs will be required, giving the most important features of the following drawings:

DRAWINGS OF THE NEBULA OF ORION.

No.	Observer.	Date.	No.	Observer.	Date.
1	Huyghens	1656	17	Rondoni	1841
2	Picard	1673	18	Lassell	1847
3	Huyghens	1694	19	W. C. Bond	1848
4	Mairan	1731	20	Lassell	1854
5	Long	1742	21	Liaponoff	1847
6	Le Gentil	1758	22	Struve	1851
7	Messier	1771	23	Secchi	1862
8	W. Herschel	1774	24	Tempel	1862
9	Lefebvre	1779	25	G. P. Bond	1865
10	Schrœter	1794	26	Rosse	1867
11	......do	1797-'98	27	Secchi	1868
12	Bodo	?	28	D'Arrest	1872
13	J. Herschel	1824	29	Winlock	1874
14	......do	1837		Trouvelot	
15	Lamont	1837	30	Holden	1876
16	De Vico	1839		Trouvelot	

Besides the above published drawings (a complete set of which is contained in no library in the world) several important unpublished original drawings have been communicated, in particular the elaborate drawing made by William Lassell, esq., with his 4-foot reflector, in 1862.

The trifid nebula (G. C. 4355) has been studied in the same way, and the results have been published in the American Journal of Science, as the Naval Observatory had no funds to pay for the necessary illustrations.

TRANSIT OF VENUS.

The work done by Prof. William Harkness is as follows:

The investigation of the errors of scale A of the measuring-engine has been finished, and the errors themselves have been tabulated. In addition, the absolute value of the scale-divisions has been determined; and, as the greatest care was taken in doing this, the engine is now capable of furnishing as accurate measurements as can be obtained by any means known to science.

The photographs of the transit of Venus obtained by the United States parties have been examined, and all those which were capable of measurement have been read off. They were as follows:

Northern stations.—Wladiwostok, 13 plates; Nagasaki, 50 plates; Peking, 26 plates; total 89 plates.

Southern stations.—Kerguelen Island, 8 plates; Hobart Town, 38 plates; Campbell Town, 32 plates; Queenstown, 47 plates; Chatham Island, 7 plates; total, 132 plates.

The grand total for both hemispheres is 221 plates. Owing to the great variability of the photographic diameters of the Sun and Venus, it was found impossible to make use of any pictures which did not show a complete image of the Sun. This excluded several hundred small photographs taken near the times of contact between the limbs of Venus and the Sun.

The measurements of the photographs mentioned above have been so far reduced that the position-angles of Venus, relatively to the center of the Sun's image, and the positions of the Sun's image relatively to the centers of the plates, have been tabulated.

A method of determining the refractive index of a piece of plano-parallel glass has been devised, by means of which the refractive indices of all the reticule plates have been very accurately measured. These refractive indices, combined with the thicknesses of the reticule plates, are the data from which certain corrections to the measured focal distances of the photographic objectives have been computed. Their further reduction is under way, and it is expected that the reduction of all the observations of the transit itself will be brought to a close by the coming spring. It is also hoped that the observations for longitudes of stations will be reduced before the end of the fiscal year, and with the present appropriation. The volume of observations will require some illustrations, and an appropriation of $1,000 for this purpose has been asked for in the estimates.

Last spring some quantities relating to the Sun and Venus were tabulated, with a view to making a duplicate computation of the solar parallax, as derived from the photographs; but, for the present, that work has been abandoned.

THE TRANSIT CIRCLE.

This instrument, under the direction of Prof. J. R. Eastman, assisted by Assistants Edgar Frisby, A. N. Skinner, and H. M. Paul, has been employed in observations of—

1. Stars of the American Ephemeris, for clock and instrumental corrections.
2. Sun, moon, and planets.
3. Stars whose occultations were observed in connection with observations of the transit of Venus in 1874.
4. Standard stars for a catalogue of zone observations.
5. Stars used by Lieut. Commander F. M. Green in the determination of latitude in the West Indies.
6. Stars of the British Association Catalogue between 120° 0′ and 131° 10′ N. P. D.
7. Stars employed in observations of comets with the 26-inch and 9.6-inch equatorials.

Clock-signals, for the determination of longitude, have been exchanged with the following stations: Cincinnati Observatory, on five nights; Hale's Eddy, N. Y., on four nights, for Coast Survey; Nashville, Tenn., on thirteen nights, for Coast Survey; Columbus, Ohio, on six nights, for Coast Survey; Wellsburg, N. Y., on two nights, for Coast Survey; Great Bend Village, Pa., on four nights, for Coast Survey; Harrisburg, Pa., on five nights, for Coast Survey.

Observations of Mars, for the determination of solar parallax, according to a plan proposed by Professor Eastman in 1876, have been made whenever the weather would permit.

THE 9.6-INCH EQUATORIAL.

This instrument is under the charge of Professor Eastman, with Messrs. Frisby, Skinner, and Paul as assistants. It has been employed in the observation of occultations and in determining the approximate corrections to the ephemerides of such small planets as are not readily found with the transit-circle.

Several observations have been made of the five comets (*a*), (*b*), (*c*), (*d*), and (*e*), of 1877.

The outer satellite of Mars was easily seen by Professor Eastman with this instrument on August 21 and 28, and by Mr. Paul on October 1.

The *meteorological department* is under the charge of Professor Eastman; and the usual observations with the *barometer*, and the *dry*, *wet*, and *solar* thermometers have been made, commencing at midnight and recorded at each period of three hours after. The observations are made by the watchmen, Messrs. Hays, Horigan, and Cahill. The 200 extra copies of the observations for 1875 are ready for distribution to our meteorological correspondents, and the observations for 1876 are now ready for the printer.

The control of the system of wires within the Observatory connecting the various clocks, chronographs, &c., and of the connections with the wires of the Western Union Telegraph Company, is, as heretofore, in the hands of the officer in charge of the transit-circle, while the immediate charge of all the batteries, wires, and their connections is successfully confided to Mr. W. F. Gardner, the instrument-maker. The connections inside the buildings remain nearly the same as during the past year.

Beyond the Observatory, this department is responsible for the control, by means of the motor-clock, of several clocks in the State, War, Navy, and Treasury Departments, and for furnishing accurate time for signals to the Western Union Telegraph Company.

A thorough change in the method of controlling these clocks is required, and a proper and creditable distribution of time-signals will require the use of another clock and a change in the present method of sending the signals. These changes will necessitate the expenditure of about five hundred dollars, which sum is asked for, for this purpose.

Condition of instruments and observing-room.—The transit-circle is in fair condition and requires only very small immediate repairs. The observing-room is in a bad condition, and grows worse every year. Nothing but an entire remodeling of the roof and shutters will make them safe or suitable for the purpose for which they were designed.

The 9.6-inch equatorial is in good condition, except that a new driving-clock is required. The dome is in good order, but the appliances are in a very bad condition—either worthless in design or worn out.

The meteorological instruments are in good condition.

The *distribution of publications and exchanges* is in charge of Prof. J. E. Nourse.

The printing of the annual volume for 1875 was begun as soon as the appropriation for 1877 was available, and it is now about half done.

Of the annual volume of the Astronomical and Meteorological Observations for the year 1874, more than 600 copies have been distributed to observatories and other scientific institutions and libraries, and an equal number of the "Instruments and Publications of the Observatory," issued at the time of the International Exhibition.

More than 400 volumes have been sent abroad, chiefly through the agency of the Smithsonian Institution. The acknowledgments for these, received from the chief scientific institutions of the world, have been expressed in very appreciative terms.

Exchanges have been fully maintained during the year, promoting the growth of the library by the acquisition of standard works. In building up a library of special character, the Observatory has been almost exclusively dependent on these exchanges. To meet the increasing demands upon it, arising out of its own extending work, and to secure its full usefulness to scientific persons seeking to avail themselves of its facilities, an appropriation has become necessary for the purchase of works not available through exchange. For this purpose the sum of $1,500 is asked for in the estimates.

The *library* occupies a space in the Observatory originally constructed for the location of one of the transit instruments. It is ill-suited for library purposes, and is now found to be entirely too small to accommodate even the volumes on hand.

NARRATIVES OF ARCTIC EXPEDITIONS.

The limited edition of the Narrative of the North Polar Expedition, prepared by the late Admiral Davis, has been nearly exhausted by the effort to supply geographical societies, public libraries, and individuals specially interested in Arctic exploration. A large number of applications for this work continue to be unwillingly declined; and it is very desirable that a new edition may be ordered by Congress, the cost of which, printed from the stereotyped plates, would be inconsiderable.

Under the orders of the Navy Department of February 17, 1877, the Narrative of the Second Expedition of the late Capt. C. F. Hall, called for by Senate resolution of February 6, is being prepared at the Observatory by Professor Nourse, with the assistance of Mr. R. W. D. Bryan, of the Polaris expedition.

An estimate of the sum required for the necessary maps and plates for this work, recommended by the department February 17, is before the Naval Committee of the Senate. The papers forming the material of this work are those purchased by Congress under the act of June 23, 1874.

CHRONOMETERS.

There are at present in the chronometer-room eighty-nine mean-time chronometers; fifty-four are ready for issue; nine are on trial, and twenty-six need repairs. There are also six sidereal chronometers, three of which are "break-circuit."

During the year, seventy-seven chronometers have been received, and sixty-one have been issued. Of these, thirty-four have been issued to vessels of the Navy.

There are also one hundred condemned chronometers stored away. Ten of the best of these have been selected, and are being cleaned and put in order, to be used as *hacks*.

In issuing chronometers to vessels it is customary to select three, by different makers, all having a regular rate, and one of the condemned ones as a "hack."

In September arrangements were perfected for dropping a time-ball in New York City at exact New York noon; and on the 10th of that month the ball was dropped from the chronometer-room for the first time. It has been dropped at New York mean noon daily, except Sundays, to the present time, without a single failure.

It may be of interest to remark that the time-ball at Deal, England, which is dropped by signal from the Royal Observatory at Greenwich, is subject to about fifteen failures annually, or to an average of 1.25 per month.

This New York time-ball is already used by the merchant shipping, and has been employed also by the navigator of the United States steamship Guard, now fitting out at the Brooklyn yard, in rating the ship's chronometers.

The Baltimore Board of Trade contemplates the establishment of a similar time-ball at Baltimore, to be dropped at Washington mean noon daily, except Sundays; and it is to be hoped that similar time-balls may be established gradually at various other ports.

Very respectfully, your obedient servant,

JOHN RODGERS,
Rear-Admiral, Superintendent.

Commodore DANIEL AMMEN, U. S. N.,
Chief of Bureau of Navigation,
Navy Department.

OFFICE OF THE CHIEF SIGNAL-OFFICER OF THE NAVY,
Washington, D. C., October 29, 1877.

SIR: In compliance with the instructions of the bureau, I have the honor to submit the following report of the operations of this office for the past year:

The experimental practice in night-signaling, designed by Lieut. E. W. Very, United States Navy, promises greater advantages than any method now practiced by us. Indeed, with a proper attention to time intervals, it seems impossible that a signal can be misunderstood, whilst rapidity in execution and simplicity in the elements employed, as well as not disclosing the character of the vessel making the signal—illuminating her, all combine to favor this system. Experiments have been made with a lantern for burning magnesium and strontium combined, and, with good results, in flash-signaling.

The advances made in electrical machines indicate proximately a wonderfully efficient and sufficiently economical appliance to insure its general employment on board of vessels-of-war. In consequence of the great increase of disasters that have occurred in thick or foggy weather by collision, it has been found necessary to devise a system of sound-signals adapted to the use of all sea-going vessels, to enable them to signal not only their position, but also the course steered, or within one point of it.

The two sirens ordered, one of which has been partially tested, promise special usefulness in fogs, through automatically whistling the course steered, or within one point, and otherwise, in phonetic general signaling.

The quarterly reports of the vessels in commission are highly satisfactory, showing that instruction in signals is no longer neglected.

Very respectfully, your obedient servant,

J. C. BEAUMONT,
Commodore and Chief Signal-Officer, United States Navy.

Commodore DANIEL AMMEN, U. S. N.,
Chief of Bureau of Navigation, Navy Department, Washington, D. C.

UNITED STATES HYDROGRAPHIC OFFICE,
Washington, September 8, 1877.

SIR: As directed by the bureau, I have the honor to forward herewith the estimates of this office for the fiscal year ending June 30, 1879.

An estimate for the contingent expenses of the expedition for the determination of longitudes, by means of the electric cable, is herewith submitted. This embraces such necessary expenses as the payment of the services of the telegraph operators, the extra expenses of parties detained on shore by their work, and the necessary transportation of such parties.

During the fiscal year ending June 30, 1877, fifty-two charts have been prepared and photolithographed; fifteen prepared for engraving, nine of which are completed and six are in progress; twelve plates have received extensive corrections, and the greater number of the plates of the office have received minor corrections in lights, beacons, recently discovered shoals, &c. Five thousand three hundred and sixteen charts and one thousand two hundred and fifty-four books, publications of this office, have been sold to its agents, for the demands of commerce, in addition to those furnished to vessels of the Navy and the exchanges with foreign offices.

Hydrographic notices and notices to mariners have, as information was received, been printed and distributed. Directions for the navigation of the coast of Chili, Bolivia, and Peru, and Nos. 1 and 2 foreign light-lists have been printed and issued. Volume I, Directory for the West India Islands; Volume III, West Coast of Africa; Volume II of the English Channel, and the Report of the Expedition for the Determination of Longitudes through the West Indies, as also Nos. 3, 4, 5, and 6 corrected lists of foreign lights, are completed and ready for printing at such time as an appropriation for the purpose is available.

In the meteorological department of this office a wind and current chart of the North Pacific Ocean, from the coast of America to 180° of longitude, has been carefully compiled, under the direction of Lieut. T. A. Lyon, U. S. N., and is nearly ready for publication.

Every preparation has been made for the continuance of the work of determination of longitudes, and the party will be ready to start by the first of October next.

During the past year surveys of shoals, &c., and search for reported dangers to navigation, have been made by the United States Steamers Pensacola, Captain Gherardi; Vandalia, Commander Robeson; Frolic, Commander G. B. White; Adams, Commander F. Rodgers; Plymouth, Captain Barrett; Ossipee, Commander L. Breeze; and Gettysburg, Lieutenant-Commander Gorringe.

The work of the United States Steamer Gettysburg progresses favorably. When taking deep-sea soundings from the Azores toward the Straits of Gibraltar, an uprising of the bottom was discovered, and a survey of its extent made, showing the least depth to be 30 fathoms.

The United States Steamer Huron, Commander Ryan, has determined the following geographical positions on the north coast of South America and the outlying islands of Unare Bay: Testigos Islands; Puerto Santo Bay; Pampatar, island of Margarita; Cumana; Tortuga Island; Corsarios Bay; Orchila Island; Los Roques Islands; La Guayra; Puerto Cabello; Island of Curaçoa; Vela de Cora; Orange-Stadt; Estanquez Point; Bahia Honda; Cape La Vela; Santa Marta, and Cartagena; carrying the longitudes, chronometrically, between Port Spain, Island of Trinidad, and Aspinwall, the longitudes of which had been determined by means of the submarine cable by Lieut. Commander F. M. Green; the latitudes of these positions being obtained by circum-meridian altitudes of fixed stars. At the same time a survey was made of the harbor of Orange-Stadt by the officers of the United States Steamer Huron. This work was carefully executed, and reflects much credit upon those connected with it.

Respectfully,

R. H. WYMAN,
Commodore United States Navy, and Hydrographer.

Commodore DANIEL AMMEN, U. S. N.,
Chief of the Bureau of Navigation.

NAUTICAL ALMANAC OFFICE,
Washington, D. C., October 24, 1877.

SIR: In accordance with your instructions, I have the honor to submit the following report of the operations of this office during the past year:

During the year ending September 30 last, 175 copies of the large edition of the Almanac have been sold, and 676 copies have been distributed to the Hydrographic Office, to the various offices of the government which make use of it, and to astronomers and scientific institutions at home and abroad. Of the small or Navigators' Almanac, 3,405 copies have been sold or sent to agents for sale.

Since the last annual report of my predecessor the printing of both the small and large Almanacs for the year 1881 has been finished, and the stereotyping of the small Almanac for 1881 is now nearly complete.

The computations of the large Almanac for 1881 will be completed early next year. Those for 1882 are in arrears and cannot be completed with the appropriation of the present fiscal year, owing to the diminution of twenty-five per cent. in the sum appropriated for computation. A diminution in the price of some of the computations will be made as soon as is admissible under existing contracts, but a diminution of one-fourth in the cost of all the computations is not practicable. An increase of the appropriation has therefore been recommended in the estimates.

During the year the office has printed an extension of Damoiseau's

Tables of the Satellites of Jupiter (those now exclusively used in preparing ephemerides of those satellites), from 1880 to 1900, by Mr. David P. Todd. The original tables terminated with the year 1880, and the extension is on the part of Mr. Todd a gratuitous contribution to science, which he has presented to astronomers through this office.

The star tables of the Ephemeris have been extended to the year 1900 during the past year, and an addition of nine stars is being made to the standard list. I shall defer recommending that the extension be printed until it is ascertained that they are wanted for use by other institutions.

The most urgent want of the office at the present time is a set of tables of the moon and planets, corresponding in accuracy to the present state of practical astronomy, and founded on entirely homogeneous data. The tables of Mars, Jupiter, and Saturn, now used in the preparation of the Ephemeris are all more than half a century old, and the only recent ones existing are those of Le Verrier. These have never been introduced in the preparation of the Ephemeris because their form is such as to render them extremely inconvenient in use, and it is doubtful whether they fulfill the requirements of the astronomy of the present day in respect to precision. Should the whole appropriation asked for this year be granted, the calculations necessary for the object in question can be commenced as soon as that appropriation is available.

Very respectfully, your obedient servant,

SIMON NEWCOMB,
Professor of Mathematics, U. S. N., Superintendent.

Commodore DANIEL AMMEN, U. S. N.,
Chief Bureau of Navigation, Navy Department.

No. 5.—BUREAU OF EQUIPMENT AND RECRUITING.

NAVY DEPARTMENT,
BUREAU OF EQUIPMENT AND RECRUITING,
Washington, October 19, 1877.

SIR: I have the honor to submit herewith the annual operations of this bureau for the past fiscal year, with estimates for the fiscal year ending 30th June, 1879.

During the past fiscal year 73 vessels have been either wholly or partially equipped at the several navy-yards, at an expenditure of $635,775.60 as follows: For labor, $72,267.39; for material from stock on hand, $461,245.99; for material purchased during the year, $102,262.22.

Fifty-one thousand four hundred and seven tons of coal have been purchased at home and abroad for the use of the Navy, under this bureau, costing, including freight, $375,700.19.

Two hundred and twenty-one thousand seven hundred and twenty-five pounds of manila hemp have been purchased, costing $20,658.53.

The ropewalk at the Charlestown navy-yard has supplied the wants of the service with wire, hemp, manila, and hide rope.

The equipment-shops at the Washington navy-yard have furnished all the anchors and chains needed for the service.

There has been expended under appropriation "equipment of vessels," during the year, for labor in the several navy-yards, $195,456, and for coal, hemp, and other articles of equipment, $543,799.56, leaving a balance on hand July 1, 1877, of $230,744.44, from which are to be paid outstanding bills amounting to $80,000.

Under appropriation "contingent," equipment and recruiting, there has been expended $42,465.93, leaving a balance on hand July 1, 1877, of $32,534.07.

During the last fiscal year coal and freight, the largest items of expenditure under cognizance of this bureau, were remarkably low; a limited number of vessels were fitted out, and the bureau was enabled to draw its supplies in a great measure from stock on hand; consequently there remains to its credit the balance above shown.

But this stock has been greatly depleted and requires to be replenished, at least in part, during the present fiscal year, in order to meet demands in fitting for sea a number of vessels to relieve others in foreign waters.

In view of the foregoing, and the further fact that $100,000 of appropriation "equipment of vessels" for the current fiscal year was by act of the last Congress especially set apart for the immediate use of the Bureau of Provisions and Clothing, it is respectfully requested that Congress may be asked to make balances above referred to available for the current fiscal year.

WIRE-BOARD.

The board established at the Washington yard for testing iron and steel wire for hawsers and standing rigging, as mentioned in my last report, has not yet completed its labors. But, under date of October 4, 1877, it reports that one hundred and eighty-six (186) different sizes of various kinds of iron and steel wire have been received, and seven hundred and seventy (770) specimens cut from them have been tested with the greatest care; no definite comparisons can fairly be made until all the specimens shall have been tested. From the care and nicety with which the experiments have been conducted, and the voluminous data already obtained, the board is of the opinion that the whole when completed will embody a large amount of valuable information.

Until this board makes its final report no more wire will be purchased, unless absolutely required for immediate use in the manufacture of rigging, and no hawsers will be made until the manufacturers in this country present an article equal to that of English production. I have no doubt that this will be done as soon as they know the character of wire required.

CHAIN-IRON.

The necessity for reliable chain-cable for our ships is so apparent, and so many chains have been parted, from defective iron, within the last few years, thereby risking a large number of lives and a vast amount of public property, that I feel bound to urge upon the department the propriety of a law sanctioning the purchase of iron for the Navy whenever it can be obtained with a view to the peculiar qualities requisite for the purpose. The practice of purchase by advertisement, and from the lowest bidder, entails upon the government a serious expense and delay in testing iron, which, in most cases, fails to meet the requirements.

The iron-board at the Washington navy-yard is constantly testing the iron of any manufacturers who may desire it, and the department ought to have the authority to purchase the iron which has passed the tests established, in the most satisfactory manner, at its market-value.

ANCHORS.

Having brought the manufacture of chain-cable for the Navy into such condition as to warrant in future the required strength and tenacity, the bureau proposes, this year, to consider the subject of anchors.

The time seems to have come when some improvements upon the old anchor may be adopted with advantage; for this purpose, manufacturers and patentees will be invited to present anchors, or models of anchors, to the commandant at the Washington navy-yard for comparative tests. We want them more readily stowed, not easy to foul, and capable of bearing equal strain with less weight of metal than the present cumbersome and somewhat crude anchor in use.

RECEIVING-SHIPS.

The receiving-ships Wabash, at Boston, Colorado, at New York, Franklin, at Norfolk, and Wyoming, at Washington, have passed satisfactory inspections.

The system of having ships in sea-trim, in preference to old hulks, as rendezvous for recruits at the naval stations has had a perceptibly beneficial effect upon the service. On board of these vessels the discipline of a man-of-war is maintained, while the men are given every opportunity for healthful amusement. The spirit of discontent which formerly prevailed at these places has almost disappeared, and desertions have very much decreased. I would recommend that the St. Louis, at Philadelphia, and Independence, at Mare Island, be replaced by vessels in reserve for sea-service, as at the stations before mentioned.

CONDUCT REPORTS.

The "conduct reports" to this bureau exhibit a manifest improvement in the conduct of the enlisted men of the Navy, and, as a consequence, the increased efficiency of the fleet in commission.

The number of desertions during the last fiscal year was 818; during the previous year, 1,203; showing a decrease of 385. These records exhibit, however, a great want of uniformity in the manner of punishing offenses, not only in different vessels of the same squadron, but in the same vessel at different times. Offenses are often punished without any apparent regard to the amount of criminality involved, particularly in cases of desertion.

It is believed that the board of officers now in session for a revision of the laws of the Navy will be able to recommend a code which will remedy these and other defects in the present naval laws.

More than three-fourths of the punishments inflicted in the Navy are for offenses committed by men under the influence of liquor. I am of the opinion that if intoxicated men were turned over to the medical officer of a ship for medical treatment, and only confined upon his recommendation, punishment would be very much lessened, and some of the very best men in the service would be saved to usefulness instead of spending months in the "brig," and perhaps years in the penitentiary, for offenses, which when sober they would never dream of committing.

On board of most ships of war, however, there are always a few men who, in the course of a cruise, exhibit uniform bad conduct. With such men punishment seems to have no beneficial effect, while their example is a constant provocation to others to do wrong. These should be discharged by sentence of summary court-martial, properly approved, wherever the ship on which they are serving may be found. The cost of transportation to the United States would be more than saved in the increased efficiency of the crew. They are known as Uncle Sam's hard bargains, and two or three of them can keep a ship in a constant state of turbulence and discontent.

HONORABLE DISCHARGES AND CONTINUOUS-SERVICE CERTIFICATES.

During the past fiscal year, 1,121 men were recommended and received "honorable discharges," and seven "medals of honor" were issued; six of the latter for saving, or attempting to save, persons from drowning, viz: To Alexander Parker (boatswain's mate), John Osborne, (ordinary seaman), Thomas Kersey (ordinary seaman), John Costello (ordinary seaman), William Corey (landsman), I. M. Frost (second class-fireman), and one to John Levy (boy), for gallant and heroic conduct at Castle Garden fire, New York.

Two thousand six hundred and sixty-six continuous-service certificates have been issued to the Navy, out of which number 700 are now in the service.

The practice of giving certificates to any person, simply on account of length of service, has been abandoned; they are only issued now upon the recommendation of commanding officers.

The naval force is small, and it is desirable to obtain only those who merit this certificate by their conduct and proficiency.

ACCOMMODATION OF ENLISTED MEN ON SEA-GOING VESSELS.

I again respectfully ask the attention of the department to the restricted space allotted to the crews of our ships of war. As a matter of efficiency alone, the health of the men is of primary importance. A ship may be ever so perfect in its construction and armament, she loses her significance as a man-of-war unless manned by a vigorous crew. It is simply impossible to expect men to retain their health if compelled to berth and mess in the dense and mephitic atmosphere which is the natural result of their crowded quarters.

I have the honor to append herewith a diagram which exhibits the cubic feet of space allotted to officers and men on the berth-decks of these ships, representing different classes of the vessels in the Navy.

Ventilation of our ships has never received the attention it imperatively demands. I respectfully urge upon the department the propriety of appointing a board of medical officers to report upon the subject, and to devise a method whereby the object may be assured.

At present the "sick-bay" is thrust in the extreme forward end of a ship, and is eminently well calculated not only to make a man sick, but to keep him so, from its position, the absence of light and air, and the usual want of the convenience which a patient requires. I believe that the plan of placing the hospital of a ship in just the place where it ought not to be has been abandoned in every navy but our own.

TRAINING SYSTEM.

Five hundred and sixty-nine boys have been enlisted during the past year under section 1418 Revised Statutes of the United States. There are remaining on board of the training-ships 458, viz: On the Minnesota, at New York, 225; on the Constitution, at Philadelphia, 124, and on the Saratoga, at Norfolk, 109.

These boys have been under especial instruction and training with a view of preparing them for future usefulness, and the bureau is gratified at the favorable reports of their commanding officers.

Three hundred and twenty-four boys are serving on cruising-vessels, having passed into the general service, viz: Hartford, 73; Essex, 57;

Adams, 72; Marion, 17; Pensacola, 19; Trenton, 46; Monongahela, 40.

That these boys are doing their duty manfully is indicated by the fact that there is scarcely a ship in commission which has not applied for its quota, to take the place of the late landsmen of the Navy.

In pursuance of this policy, the bureau has also enlisted a small experimental class of boys for the "engineers' force." These are now making a practice-cruise on the Tallapoosa. Her commanding officer reports them "all, without exception, well-behaved and anxious to learn."

Under the present system, these lads can hardly be considered as of any expense to the government; in fact, taking the place of men of higher rates of pay in the cruising vessels, they might be considered as saving money to the service. If 750 (10 per cent. of the whole force of the Navy) are to be allowed, the additional amount of pay needed will be about $90,000.

As a proper adjunct to the present training system, and for the purpose of inciting the young seamen to master their profession by offering as rewards such positions as properly come within the limits of their ambition, I recommend that boys who have enlisted to serve in the Navy until twenty-one years of age, who have served out such enlistment, and have been recommended for a "good-conduct badge," may, upon re-entering under continuous-service certificate, be ordered to the Minnesota at New York, with the object of going through a course of instruction to fit them for the rate of petty officers, and finally, that such as are peculiarly deserving through proficiency and good conduct be made eligible for promotion to the position of warrant-officer. In this connection, I have the honor to recommend that no further appointments of warrant-officers be made until the opportunity is offered to fill them from these enlisted boys.

The corps of warrant-officers has fallen somewhat into disrepute from the large number among them who are either professionally or physically incompetent to fulfill their duties.

The above proposition would bring into that portion of the service a fresh element of young and thoroughly-trained American man-of-war's men, and would present an additional inducement for the enlistment of American-born boys. If, in addition to this introduction of young men identified with the Navy into these grades, recognized rank could be given them, as in the English navy, all, or the most meritorious, of the present incumbents to rank with, but next after, ensigns, but with no additional right to quarters, when retired after good and faithful service to rank with masters on the retired-list, and a division made into first and second classes by examination and record, in my opinion the efficiency of the Navy would be increased, and the position of warrant-officer be rendered much more desirable than at present.

OUTFITS.

I have again to ask the attention of the department to the absolute propriety of obtaining from Congress the appropriation of a sum of money sufficient to furnish every enlisted man and boy in the Navy with an outfit not exceeding fifty dollars. This outfit is particularly vital to the permanence of the training system. The boys who enlist for the service are generally of poor parentage, and it is quite obvious that, with their very small pay, they enter the Navy burdened with a debt which it takes months to pay. In many cases the clothes are worn out before they are paid for. It is equally just to the enlisted man of the

Navy that the outfit which is given to the soldier and marine should be given him.

The amount required would be about $125,000 per annum.

BANKING SYSTEM.

I again respectfully urge the passage by Congress of a bill to the following effect, viz:

> *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That the provisions of the act approved May 15, 1872, entitled "An act to establish a system of deposits, to prevent desertion, and elevate the condition of the rank and file of the Army," so far as they relate to the payment of interest on deposits, be extended to include the payment of interest, at the rate of 4 per cent. per annum, to the appointed and enlisted petty officers, seamen, ordinary seamen, landsmen, boys, and marines in the naval service, on the amounts of their pay, respectively, that may be retained and borne to their credit on the books of the several pay-officers of the Navy, under such regulations and restrictions as the Secretary of the Navy may establish.

This law is in force in the Army with the most beneficial results, reducing desertion, and in every other way improving its tone and *morale*.

It seems just that the money of the sailor which lies in the Treasury of the United States, sometimes for three years, should receive a moderate rate of interest. The sum required to pay this interest would not amount to more than $25,000 per annum.

The bureau has made no contracts for supplies during the past fiscal year. Coal, hemp, and the more important supplies have been purchased from time to time in quantities as needed for the wants of the service, by advertisement, in the manner prescribed by law.

Other minor supplies required by the commandants, upon duly approved requisitions, for immediate use in fitting out vessels at the several naval stations, have been procured by the purchasing-agents, respectively.

The administration of this bureau during the past year has afforded me much gratification, from the fact that I have seen a gradual improvement in the rank and file of the Navy and an increased economy in outfits of ships. In the duty assigned me, I have been cheerfully sustained by the commandants and equipment-officers at the yards, the commanding officers of receiving and training ships, and by the civil employés of the bureau.

Very respectfully, your obedient servant,

R. W. SHUFELDT,
Chief of Bureau.

Estimates of appropriations required for the service of the fiscal year.

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1877.
SALARIES, BUREAU OF EQUIPMENT AND RECRUITING.		
Chief clerk, per Rev. Stat., page 69, section 416, and per act March 3, 1877, vol. 19, page 312, section 1	$1,800	
Additional for chief clerk, submitted	200	
One clerk of class 4, per Rev. Stat., page 26, section 167, and per act March 3, 1877, vol. 19, page 312, section 1	1,800	
One clerk of class 3, same acts	1,600	
Two clerks of class 2, same acts	2,800	

Estimates of appropriations required for the service of the fiscal year—Continued.

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1877.
SALARIES—Continued.		
Two clerks of class 1, same acts	$2,400	
One messenger, same acts	840	
One laborer, same acts	720	
	12,160	$11,960
NOTE.—The item "Two clerks of class 1" was included in the estimates for the current fiscal year, and was embraced in the appropriation bill as it finally passed the House of Representatives, but by a clerical error was omitted in enrolling the bill, although the amount of their pay was appropriated.		
CONTINGENT EXPENSES, BUREAU OF EQUIPMENT AND RECRUITING.		
Stationery, books, and miscellaneous items (appropriated) March 3, 1877, vol. 19, page 312, section 1	800	500
PAY OF THE NAVY.		
Pay of commissioned and warrant officers at sea, on shore, on special service, and those on the retired list and unemployed; and for mileage and transportation of officers traveling under orders; and for pay of the petty officers, seamen, ordinary seamen, landsmen, and boys, including men for the engineers' force and for the Coast-Survey service, 7,500 men, at the pay prescribed by law, as per Rev. Stats., page 264, sections 1556 to 1595, and act June 30, 1876, vol. 19, page 65, section 1	7,350,000	
Pay of 750 boys, recommended to be enlisted for training, at average pay of $120 per annum, submitted	90,000	
	7,440,000	6,600,000
EQUIPMENT OF VESSELS.		
Coal for steamers' and ships' use, including expenses of transportation, storage, and labor; hemp, wire, and other materials for the manufacture of rope; hides, cordage, canvas, leather; iron for the manufacture of cables, anchors, galleys, and chains; furniture, wood, bake-ovens, and cooking-stoves; boat-detaching apparatus, life-rafts and hose; heating-apparatus for receiving-ships; and for pay of labor in equipping vessels and manufacture of equipment articles in the several navy-yards, as per Rev. Stats., page 738, sections 3709 and 3747 (appropriated), vol. 19, page 387, section 1	1,250,000	970,000
CONTINGENT, BUREAU OF EQUIPMENT AND RECRUITING.		
Expenses of recruiting and fitting up receiving-ships; freight and transportation of stores, transportation of enlisted men, printing, advertising, telegraphing, books and models, stationery, express charges; internal alterations, fixtures, and appliances in equipment buildings at the several navy-yards; foreign postage, car-tickets, ferriage, ice, apprehension of deserters, assistance to vessels in distress, continuous-service certificates, and good-conduct badges for enlisted men, including purchase of school-books for training-ships, per Rev. Stats., page 726, section 3666, and (appropriated), vol. 19, page 388, section 1	75,000	65,000
CIVIL ESTABLISHMENT, BUREAU OF EQUIPMENT AND RECRUITING.		
Navy-yard at Kittery, one clerk	1,300	
Navy-yard at Boston, one superintendent rope-walk	1,800	
one clerk	1,400	
one clerk	1,300	
one writer	1,017	
Navy-yard at New York, one clerk	1,400	
one clerk	1,300	
Navy-yard at League Island, one clerk	1,300	
Navy-yard at Washington, one clerk	1,400	
one clerk	1,300	
one writer	1,017	
Navy-yard at Norfolk, one clerk	1,300	
Navy-yard at Pensacola, one writer	1,017	
Navy-yard at Mare Island, one clerk	1,400	
	18,251	....

No. 6.—BUREAU OF ORDNANCE.

BUREAU OF ORDNANCE, NAVY DEPARTMENT,
Washington City, November 7, 1877.

SIR: I have the honor to submit the annual report of this bureau, with accompanying detailed estimates, for the fiscal year ending June 30, 1879.

These estimates have been revised and reduced to the smallest sum consistent with efficient current service, and with no provision for replacing our obsolete armament of smooth-bores with rifled cannon.

ESTIMATES.

1. Labor, tools, materials, and fuel used in fitting ships for service, and preservation of ordnance and ordnance-stores	$372,658
2. Repairs to buildings, magazines, wharves, gun-parks, tugs, lighters, and boats	89,177
3. Torpedo-service	171,551
Civil establishment at navy-yards	11,886
Total	645,271

A supplementary estimate is submitted for rifled cannon, their carriages, powder and projectiles for batteries of ships, and for armament of five double-turreted monitors now building.

The first item is somewhat greater than the amount estimated for last year, because the stock of materials on hand has been gradually expended and worn out in service, and wooden carriages need replacing with iron ones; but, while estimating as above for the current service, in order to keep pace with modern and well-established principles in the armament of our ships, this sum should be doubled.

REPAIRS.

The sum of $89,177, estimated for repairs, is most urgently required. The magazines, wharves, &c., are necessarily placed in exposed situations and require constant repair. The necessity of repairing the bulkhead surrounding the ordnance dock at New York has been for several years pressed on the attention of Congress, and as no appropriation has been made, slight defects have become very serious ones, and this valuable property is not only liable to great damage, but also the harbor of New York to great injury by washing the filling into the East River.

At the Norfolk station a small appropriation two years ago enabled me to place everything in good condition.

At all the other stations damage by storms and decay from ravages of worms and rot make the estimated repairs essential.

TORPEDOES.

With our very small force of ships and great extent of coast, the development of the torpedo-service becomes of paramount importance. As much of the equipment can be improvised, an attacking or blockading force can be much disquieted, if not destroyed, by very simple means, directed by brave and skillful officers.

Certain portions of the apparatus require time for their preparation, and cannot be readily obtained; careful test and practice in the use of the apparatus are necessary to give confidence to the officer who under-takes the hazardous operation of attacking a large vessel or of defending his own from a pigmy foe.

It is probable that the limited use of torpedoes in the war now in progress is due to a want of confidence as well as of the skill obtained by practice.

The torpedo station at Newport, R. I., with its efficient commandant and instructors, turns out every year a well-instructed class of officers; but the force and means of instruction should be increased to such extent as to admit of rapid expansion if a necessity should occur.

Commanders Selfridge, Bunce, and Norton attended the course of instruction the past season; and it is to be expected that their example will be followed by others who are unwilling to remain unable to judge of the value of this efficient auxiliary for want of experimental knowledge.

CONVERSION OF SMOOTH-BORE CANNON TO RIFLE.

Ten 11-inch smooth-bores have been finished and twenty are in process of conversion to 8-inch muzzle-loading rifles by the approved method of lining with a wrought-iron tube. This conversion adds 25 per cent. to the power of the gun at the muzzle and doubles it at 1,000 yards.

The increased recoil required alterations in the carriage for its efficient control, which have been devised and answer well the purpose.

Ten 100-pounder muzzle-loading Parrott rifles are being converted to breech-loaders, for the armament of our narrow-beam sloops, on the slotted-screw principle, commonly known as the French closure, although an American device.

RIFLE-CANNON.

The sole object of a vessel of war is to make an exhibition of force when needed. Therefore her armament should be of the most approved type for a vessel of her class. In the era of wooden ships and smooth-bore cannon our vessels were a little superior to those of any other nation. During the past fifteen years a great advance has been made abroad, while we have remained nearly stationary. But the rifled cannon, having passed the experimental stage, is now adopted by all the maritime powers as the sole armament. Wherefore, if we are to maintain a Navy, we must adopt the rifle-cannon, or, in the event of collision, be forced to an unequal contest. There are several approved types of both breech and muzzle loaders, from which we can select the one most suitable without any great cost of experiment.

The sum of $762,000 is estimated as necessary for this purpose, and not less than a year would be required after an appropriation should be made before the first gun could be delivered.

EXPERIMENTS.

During the past fiscal year the appropriation has been too small to permit any experimental investigations. Such incidental trials of fuses and projectiles have been made as occurred in the test of current manufactures.

A small estimate is submitted, as without experiment meritorious inventions are not developed and plausible ones accepted.

A number of reports of value to the Navy are appended.

I am, with great respect, your obedient servant,

WILLLIAM N. JEFFERS,
Commodore, Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

Manufactures and preparations at the various navy-yards for the year ending June 30, 1877.

ARTICLES UNDER PROPORTION TO EACH GUN.

2 circular-brake carriages, 8-inch muzzle-loading rifle.
4 hydraulic-buffer carriages, 8-inch muzzle-loading rifle.
2 central-compressor carriages, 8-inch muzzle-loading rifle.
4 shell-bearers, 8-inch muzzle-loading rifle.
8 shifting-chocks, 8-inch muzzle-loading rifle.
20 canister, 8-inch muzzle-loading rifle.
14 pivot-bolts, 8-inch muzzle-loading rifle.
22 sets side-sights, 8-inch muzzle-loading rifle.
2 side-sight boxes, 8-inch muzzle-loading rifle.
3 trunnion-sights, 8-inch muzzle-loading rifle.
12 rear-sight covers, 8-inch muzzle-loading rifle.
12 front-sight covers, 8-inch muzzle-loading rifle.
7 sponges, bristle, 8-inch muzzle-loading rifle.
20 trunnion-eccentrics, 8-inch muzzle-loading rifle.
4 tompions and wads, 8-inch muzzle-loading rifle.
2 impression-takers, 8-inch muzzle-loading rifle.
20 canister-boxes, 8-inch muzzle-loading rifle.
6 cranks, 8-inch muzzle-loading rifle.
13 pivot shackle-plates, 8-inch muzzle-loading rifle.
15 rammers, 8-inch muzzle-loading rifle.
4 shell extractors, 8-inch muzzle-loading rifle.
11 shell-boxes, 8-inch muzzle-loading rifle.
24 passing-boxes, 8-inch muzzle-loading rifle.
3 breeching, 11-inch.
24 tackles, 11-inch.
4 sponges, woolen, 11-inch.
20 shell-boxes, 11-inch.
2 tompions and wads, 11-inch.
37 breeching, 11-inch.
186 tackles, 11-inch.
23 sponges, woolen, 11-inch.
10 rammers, 11-inch.
500 shell-boxes, 11-inch.
36 tompions and wads, 11-inch.
2 breeching, 60-pounder.
36 tackles, 60-pounder.
15 pivot-bolts, 60-pounder.
2 sponges, woolen, 60-pounder.
2 tompions and wads, 60-pounder.
5 directing-bars, 60-pounder.
4 sets carriage-castings, 60-pounder.
24 breeching shackle-pieces, 60-pounder.
18 breeching-bolts, 60-pounder.
1 carriage, 100-pounder, Marsilly.
1 rack, 80-pounder, breech-loading.
1 breech-plug handle, 80-pounder breech-loading.
3 20-pounder breech-loading rifle.
2 carriages, 20-pounder breech-loading rifle.
2 directing-bars, 20-pounder breech-loading rifle.
9 elevating-screws, 20-pounder breech-loading rifle.
2 Broadwell rings, 20-pounder breech-loading rifle.
3 breech-sights, 20-pounder breech-loading rifle.
14 rammers, 20-pounder breech-loading rifle.
4 worms and ladles, 20-pounder breech-loading rifle.
12 tackles, 20-pounder breech-loading rifle.
5 breechings, 20-pounder breech-loading rifle.
2 sponges, woolen, 20-pounder breech-loading rifle.
1 sponge, bristle, 20-pounder breech-loading rifle.
45 shells, 20-pounder breech-loading rifle.
3 pivot-bolts, 20-pounder breech-loading rifle.
4 bronze carriages, 20-pounder rifle, muzzle-loading.
70 chocking-quoins.
20 muzzle-bags.
147 gun-gripes.
13 loading-tongs.

4 shell-box covers.
121 blocks; metal, double.
72 block-pins.
12 wash-deck chocks.
52 lock-straps.
6 lock-covers.
2 fuse-cutters.
84 friction-primer lanyards.
36 fuse-pickers.
14 linchpins.
1 set transporting axle and trucks.
19 handspikes, roller.
240 port-lanyards.
56 fire-bucket lanyards.
18 division and supply boxes.
1 extension piece.
10 division-tubs.
6 fire-tubs.
132 selvagees.
140 heavers for selvagees.
65 sponge-covers, canvas.
16 shell-whips.

HOWITZERS, EQUIPMENTS, ETC.

7 howitzers, steel, 3-inch breech-loading.
5 howitzers, bronze, 3-inch breech-loading.
1 Hotchkiss, 3-inch, breech-loading rifle.
3 boat-carriages, 3-inch, breech-loading howitzer.
8 field-carriages, 3-inch breech-loading howitzer.
32 field-carriage wheels.
4 sets wheel-shoes.
60 caisson-boxes; 6 elevating-screws.
99 passing-boxes
18 Broadwell rings.
2 cartridge-bag formers.
853 shells, 3-inch breech loading howitzer.
80 shrapnel, 3-inch breech-loading howitzer.
5 rammers and sponges, 3-inch breech-loading howitzer.
770 sabots.
624 Bormann fuses.
1 gun-cover for breech-loading howitzer.
24 train-ropes.
18 drag-ropes.
12 sponge-covers.
14 rings for sponge-buckets.
20 buckles for sponge-buckets.
10 tripods, Gatling gun.

SMALL-ARMS.

20 pairs arm-chest hinges.
18 pairs arm-chest hasps.
86 single-sticks.
21 arm-chests.
455 rear sight-guards.
8 boxes for spare parts.
250 cutlass-scabbards.
120 cutlass-scabbards frogs.
219 pistol-boxes.
46 battle-axe frogs.

MAGAZINE STORES.

232 cartridge-bag springs.
2, 135 adapting-rings, Scheukl fuse.
500 cartridge-bags, 8-inch.
725 cartridge-bags, 3-inch breech-loading howitzer.
12 cartridge-bags, 20-pounder breech-loading rifle.
49, 600 primers, cannon.
6, 019 primers, cannon, quill-friction.
565 charges, 3-pound saluting.
128 charges, 3-inch breech-loading howitzer.

4 magazine-dresses.
10 pairs magazine-shoes.
3 magazine-screens.
230 Boxer fuses.
500 paper caps, Boxer fuse.
889 igniters.
400 Boxer fuse cases.
100 experimental fuse-cases.
1 powder-hopper.
3 powder-whips.
4 water-buckets.

TORPEDOES.

15 sets torpedoes, complete, prepared.
27 bridles, wire.
1,050 feet ash, Scotchman.
10 torpedo-tackles, 20 torpedo-guys.
3 sets torpedo-gear.
Repairs to deteriorated stores on hand.
Repairs to tools, &c.
Repairs to buildings and wharves.
Experimental work of all kinds.

MISCELLANEOUS ARTICLES.

9 sets deck-circles.
2,014 deck-circle screws.
5 clevis-bolts.
13 shifting chock-plates.
5 pivot-clamps.
6 pivot-clamp bolts.
16 pivot-sockets.
8 sets hose-couplings.
17 tallies.
2 pendulums.
20 powder-scuttles.
9 tin cans.
4 tin measures.
27 sponge-worms.
48 hooks and thimbles.
35 wrenches.
12 dummy friction-primers and lanyards.
Test-specimens.
Rings for pressing bands on shells.
Templates, assorted.
Tools, assorted.
1 hand-cart.
9 pressure-gauges.
887 pressure disks, copper.
3 pressure-disk housings.
5 pressure-gauge rammer and disk.
100 gas-checks for pressure-gauges.
1 sighting-instrument for 8-inch muzzle-loading rifle.
64 rammer and sponge hooks.
1 set tackles and gripes for steam-dingey.
1 cover for engine for steam-dingey.
100 hooks and runners for primer-lanyards.
12 stud-pins for friction-primers.
1 testing-platform.
72 sets cutlass-brackets.
69 sets battle-axe brackets.
1 piston for buffer-carriage.
5 sets target-fittings.
140 port lanyard-hooks.
14 shell-whip hooks.
1 powder-chute.
1 screw-plate and tap-plate.
41 swabs.
11 handspike shoes.
10 snow-shovels.
1 gun-sling chain.
540 shell-plugs.

8 sweep-pieces.
Patterns, assorted.
Flasks and molding-boards, assorted.
1 chill-mold for 20-pounder-ball plug.
1 smoke-stack for boilers.
1 pressure-plug for Woodbridge fuse.
1 swage-plug for Woodbridge fuse.
1 set grate-bars for boilers.
12 shot-tongs.
6 dummy-shot, wood.
667 sabots.
Repairs to stores on hand.
Repairs to tools.
Repairs to buildings, wharves, shot-beds, gun-skids, &c.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, by the Bureau of Ordnance, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
SALARIES.		
Chief clerk (Rev. Stats., p. 70, sec. 416; appropriated, act March 3, 1877, 19 Stats. at L., p. 312, sec. 1)	$1,800	....
Draughtsman (Rev. Stats., p. 70, sec. 416; appropriated, act March 3, 1877, 19 Stats. at L., p. 312, sec. 1)	1,800	....
One clerk of class three (Rev. Stats., p. 26, sec. 167; appropriated, act March 3, 1877, 19 Stats. at L., p. 312, sec. 1)	1,600	....
Two clerks of class two (appropriated, act March 3, 1877, 19 Stats. at L., p. 312, sec. 1)	2,800	....
One messenger (appropriated, act March 3, 1877, 19 Stats. at L., p. 312, sec. 1)	840	....
One laborer (appropriated, act March 3, 1877, 19 Stats. at L., p. 312, sec. 1)	720	....
	9,560	$9,560
CONTINGENT EXPENSES.		
Stationery, books, and miscellaneous items (appropriated March 3, 1877, 19 Stats. at L., p. 312, sec. 1)	800	400
ORDNANCE AND ORDNANCE STORES.		
Fuel, tools, and material of all kinds necessary in carrying on the current daily work of mechanical branches of the ordnance department of the several navy-yards, magazines, and stations (appropriated, 19 Stats. at L., p. 387, sec. 1)	126,776	....
Labor at the several navy-yards, magazines, and stations in fitting ships for sea and in preserving ordnance material (appropriated March 3, 1877, 19 Stats. at L., p. 387, sec. 1)	223,457	....
Miscellaneous items, to wit: Freight to foreign and home stations; advertising and auctioneers' fees; cartage and express-charges; repairs to fire-engines, gas and water pipes; gas and water tax at magazines; toll, ferriage, foreign postage, telegrams, &c. (appropriated, 19 Stats. at L., p. 387, sec. 1)	7,425	....
NOTE.—The above estimates are based on the experience of several years, and the amounts are necessary for the efficiency of the service.		
Experiments in ordnance at the naval experimental battery, and navy-yard, Washington (appropriated, 17 Stats. at L., p. 549)	15,000	....
	372,658	178,000
NOTE.—Without experimental trials no progress can be made; useful inventions are liable to rejection, and plausible innovations to be adopted. Furthermore, current work requires actual trial to detect defects.		
Necessary repairs to ordnance buildings, gun-parks, magazines, boats, lighters, wharves, machinery and appendages, including—		
Navy-yard, Portsmouth, N. H.:		
To ordnance buildings and grounds (appropriated, 19 Stats. at L., p. 387, sec. 1)	800	....
To engines, machinery, &c. (appropriated, 19 Stats. at L., p. 387, sec. 1)	200	....
Painting sheds, and repairs at magazine (appropriated, 19 Stats. at L., p. 387, sec. 1)	550	....

Estimate of appropriations required for the service of the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
Navy-yard, Boston, Mass.:		
To buildings and grounds, engines, for new machinery, &c. (appropriated, 19 Stats. at L., p. 387, sec. 1)	$1,000	....
To buildings, grounds, and railway at magazine (appropriated, 19 Stats. at L., p. 387, sec. 1)	1,200	....
Navy-yard, Brooklyn, N. Y.:		
To the ordnance dock (appropriated, 19 Stat. at L., p. 387, sec 1)	45,748	....
NOTE.—Attention is called to the absolute necessity for this expenditure.		
General repairs at magazine, Ellis Island (appropriated, 19 Stats. at L., p. 387, sec. 1)	1,785	....
To machinery tug, powder-boat, and lighter (appropriated, 19 Stats. at L., p. 387, sec. 1)	2,624	....
Naval magazine, Fort Mifflin, Philadelphia, Pa.:		
General repairs to buildings and grounds (appropriated, 19 Stats. at L., p. 387, sec. 1)	4,220	....
Navy-yard, Washington, D. C.:		
To gun and shot parks, experimental and saluting batteries (appropriated, 19 Stats. at L., p. 387, sec. 1)	2,500	....
To engines, machinery, and furnaces (appropriated, 19 Stats. at L., p. 387, sec. 1)	500	....
General repairs to buildings and grounds at Branch and Bellevue Magazines, (appropriated, 19 Stats. at L., p. 387, sec. 1)	2,000	....
Navy-yard, Norfolk, Va.:		
General repairs to buildings, grounds, boats, lighters, wharves, machinery, &c., at navy-yard, the gun-park at Saint Helena, and at Fort Norfolk, and Craney Island magazine (appropriated, 19 Stats. at L., p. 387, sec. 1)	10,000	....
Navy-yard, Mare Island, Cal.:		
General repairs to buildings and grounds, and to fences, wharf, &c., at magazine (appropriated)	7,550	....
Naval experimental battery, Annapolis, Md.:		
General repairs to buildings, wharf, &c. (appropriated)	2,000	....
	82,677	$10,000
NOTE.—For several years the appropriation for repairs has been so much reduced that the buildings and wharves, which are necessarily in exposed situations, are becoming quite dilapidated.		
Improvements, as follows, viz:		
Navy-yard, Mare Island, Cal.:		
Construction of gun-skids (submitted)	4,000	....
Filling and tank-house near magazine, for filling powder and shell, and stowing empty tanks (submitted)	2,500	....
	6,500	....
CONTINGENT.		
Contingent expenses of the ordnance service of the Navy (appropriated, 19 Stats. at L., page 387, sec. 1)	1,000	1,000
TORPEDO CORPS.		
Labor (appropriated, 19 Stats. at L., p. 387, sec. 1)	36,000	....
Material (appropriated, 19 Stats. at L., p. 387, sec. 1)	10,000	....
Coal and gasoline (appropriated, 19 Stats. at L., p. 387, sec. 1)	6,000	....
Freight, express charges, telegrams, &c. (appropriated, 19 Stats. at L., p. 387, sec. 1)	500	....
General repairs (appropriated, 19 Stats. at L., p. 387, sec. 1)	5,000	....
Sea-wall (appropriated, 19 Stats. at L., p. 387, sec. 1)	5,000	....
Apparatus for instruction in electricity (appropriated, 19 Stats. at L., p. 387, sec. 1)	7,245	....
Material for electrical department (appropriated 19 Stats. at L., p. 387, sec. 1)	2,050	....
Apparatus, &c., for improvement of torpedoes (appropriated, 19 Stats. at L., p. 387, sec. 1)	2,393	....
Apparatus, &c., to develop electricity to signaling, lighting, &c. (appropriated, 19 Stats. at L., p. 387, sec. 1)	26,613	....
Chemical apparatus, &c., for instruction (appropriated, 19 Stats. at L., p. 387, sec. 1)	12,350	....
Instruction, and general torpedo experiments, including fast launch (appropriated, 19 Stats. at L., p. 387, sec. 1)	44,300	....
Experiments with submarine projectiles (appropriated, 19 Stats. at L., p. 387, sec. 1)	5,000	....

Estimates of appropriations required for the service of the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
Expenses of the Board of Visitors (appropriated, 19 Stats. at L., p. 387, sec. 1)		$1,000	....
Improvements, viz.: draughting-room, library, books, &c. (submitted)	$2,000		
Reservoir, $1,500; raising stable, $500; 2 small magazines, $250 (submitted)	2,250		
Blacksmith-shop, removing steam fire-engine, &c. (submitted)	1,500		
Magazine on Rose Island, $500; boat-shed on wharf, $100 (submitted)	600		
Boat-shed for all boats (submitted)	1,000		
Repairs to working laboratories of nitro-glycerine, &c. (submitted)	750		
		8,100	....
		171,551	$38,500

NOTE.—The appropriations heretofore made have been simply sufficient for caring for government property, receiving and forwarding outfits of ships, &c. The above estimates are based upon progressive action, and to enable the Torpedo Corps to attain an advance over other countries, or at least to keep even with them.

CIVIL ESLABLISHMENT.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
Navy-yard, Portsmouth, N. H.:		
One clerk, (appropriated, 19 Stats. at L., p. 386, sec. 1)	$1,300 00	....
Navy-yard, Boston, Mass.:		
One clerk, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,400 00	....
Navy-yard, Brooklyn, N. Y.:		
One clerk, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,400 00	....
One writer, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,017 25	....
Navy-yard, League Island, Pa.:		
One writer, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,017 25	....
Navy-yard, Washington, D. C.:		
One clerk, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,400 00	....
One writer, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,017 25	....
Navy-yard, Norfolk, Va.:		
One clerk, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,300 00	....
Navy-yard, Pensacola, Fla.:		
One writer, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,017 25	....
Navy-yard, Mare Island, Cal.:		
One writer, (appropriated, 19 Stats. at L., p. 386, sec. 1)	1,017 25	....
	11,886 25	....

ORDNANCE AND AMMUNITION.

Supplementary.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
For the batteries of ships, and as a reserve:		
20 smooth-bore XI-inch guns, converted to 8-inch rifles, at $2,450 (submitted)	49,000 00	....
20 carriages for same, at $3,800 (submitted)	76,000 00	....
2,000 projectiles, at $18 (submitted)	36,000 00	....
700 barrels powder, at 30 cents per pound (submitted)	21,000 00	....
For the armament of five double-turreted monitors, viz: Puritan, Monadnock, Miantonomoh, Amphitrite, and Terror:		
20 rifled cannon, at $15,000 (submitted)	300,000 00	....
20 carriages, at $6,000 (submitted)	120,000 00	....
2,000 projectiles, at $50 (submitted)	100,000 00	....
2,000 barrels powder, at 30 cents per pound (submitted)	60,000 00	....
	762,000 00	....

Respectfully submitted.

WILLIAM N. JEFFERS,
Chief of Bureau.

OCTOBER 6, 1877.

WEST POINT FOUNDRY,
Cold Spring, N. Y., July 2, 1877.

SIR: In obedience to your instructions I have the honor to submit the following report of the conversion and proof-trial of a 100-pounder Parrott rifle converted into an 80-pounder breech-loader with a steel lining.

For proof-trial the gun was mounted on a wooden Marsilly carriage, and the shot were fired into a butt distant 150 feet from the muzzle of the gun. Tables of velocities, pressures, and useful effects are herewith transmitted. The velocities were taken with Benton's thread velocimeter, and the pressures partly with the Rodman pressure-gauge and partly with a spiral gauge screwed into the face of the nose-plate. The former gave in many cases most abnormal pressures, probably owing to the force of impact being caused by a blow instead of a pressure.

PROCESS OF CONVERSION.

The breech of the gun to be converted was first cut off at the base-ring, the old band removed, and the gun bored out from the rear to receive the steel tube. This boring extends to a point 12 inches in front of the axis of the trunnions. For a distance of 12.5 inches from the base-ring the diameter of the boring was 11.75 inches, and for the remaining portion 8.30 inches, the two portions being joined together by a rounded shoulder. A square-shouldered female thread was cut around the circumference of the boring at the breech end, corresponding to a male thread on the tube. The tube fitted to this casing was made from a solid ingot of cast-steel, 20 inches square, obtained from the Midvale Steel Works, Philadelphia. When finished its dimensions were as follows, viz:

	Inches.
Length of tube	58.2
Length of re-enforce portion	12.2
Thickness of re-enforce	1.85
Thickness of tube forward of re-enforce	1.415
Diameter of bore	6.4
Diameter of screw-chamber	7.5
Exterior diameter of tube at re-enforce	12.0
Exterior diameter of tube forward of re-enforce	9.43
Length of screw-thread	12.15
Depth of screw-thread	0.12
Pitch of screw-thread	2.08

In fitting the tube into its casing the latter was placed upright in a charcoal-furnace, with the top of the furnace filled in flush with the breech, leaving the bore clear for entering the tube. The heat in the furnace circulated around the outside of the casing, and was not allowed to enter the bore.

The tube was suspended from a crane immediately over the bore, and when the casing was sufficiently expanded (0.001 inch) it was lowered down and screwed firmly into place. The old band, which had been removed, was lengthened from 27 inches to 39 inches, bringing it forward to within 2.75 inches of the rimbases, and was shrunk on the gun with a shrinkage of 0.06 inch. The gun was then put on the rifling-machine and the original rifling remaining in the portion of the bore not enlarged was continued upon the steel tube. This rifling is on the following system, viz:

Twist increasing from zero to one turn in 19 feet at the muzzle.

	Inches.
Lands and grooves, equal (width)	1.2566
Depth of grooves	0.10
Length of rifling	124.0

The breech of this gun was closed with a screw-plug, and the Boardwell ring was first used as a gas-check. The breech-plug, and screw-box in which it works, being reciprocally slotted, the plug can be shoved in by hand until only a sixth of a turn is sufficient to give it a firm bearing against the Broadwell ring.

A revolving nose-plate on the forward face of the plug facilitates unlocking after firing, and prevents any grinding across the face of the Broadwell ring. The vent is horizontal, passing through the center of the plug and nose-plate. The gun when finished weighed 10,150 pounds, and had no preponderance.

PROOF-TRIAL.

The gun has been fired 277 rounds with charges of 10 and 12 pounds of rifle-powder and a shot weighing 80 pounds.

The expanding ring on the old Parrott shot was found too weak to withstand the quick-burning powder used in this gun, and a stronger one of different shape was substituted in its place.

A change of form also was made in the base of the projectile so as to prevent any chipping off of the iron in front of the band; and with these alterations a very satisfactory result has been obtained.

SERVICE OF THE GUN.

In the service of the gun it was found that four men were sufficient for cleaning and loading, and with a mechanical carriage the gun might easily be worked by that number. At the commencement of the proof-trial (December 19, 1876) water was freely used as a lubricator in cleaning the breech-plug and screw-box. As the weather grew colder much inconvenience was experienced from the water freezing and forming a coating of ice on the threads of the screw-box. The use of oil was attempted as a lubricator, but that also congealed and left a gummy deposit, causing the plug to stick after firing. Attempts at lubrication were then abandoned, and the threads were simply wiped dry with a rag or swab, and this was found to answer every purpose. At this time also sponging was abandoned, as it was found that the passage of the sponge through the screw-box left an amount of dirt which it was difficult to remove, and prevented the threads from being kept clean and bright. Fifty rounds, as an experiment, were fired without sponging, and as no inconvenience resulted and the service of the gun was much simplified this method of service was continued. The expanding ring on the shot seemed to sweep out the grooves each round and prevented any deposit from accumulating.

GAS-CHECKS.

The Broadwell ring, with which 247 rounds were fired, did its duty thoroughly, and required no particular care or attention. The face of the ring was wiped off after each round, and the bearing surface on the nose-plate cleaned with alcohol.

Thirty rounds were fired with a new cup gas-check. This gas-check is somewhat similar in form to the Broadwell ring, but is less in diameter, and presents a smaller surface for the action of the powder-gas, and consequently brings a less strain on the breech-plug and its supports.

BREECH MECHANISM.

The breech-closing apparatus gave during the proof-trial the most satisfactory results, and can be relied upon for strength and efficiency.

If the threads are kept dry and carefully wiped after each round no difficulty in locking or unlocking will be experienced. Where sponging is abandoned or used only at intervals, and with no escape of gas past the Broadwell ring, very little dirt of any kind can reach the threads of the plug or screw-box, and they can easily be kept clean by wiping after each round.

VENT-CHECKS.

The cartridge being ignited by a central vent through the plug and nose-plate, several kinds of interior vent-checks were experimented with, but none of them gave very satisfactory results. The bureau finally directed that a copper bushing with a reduced vent, 0.07 inches in diameter, be set into the face of the nose-plate. This was found to answer very well, and allowed but little escape of gas, at the same time requiring no care to keep it in order.

SYSTEM.

Whatever the ultimate endurance of this system may prove to be, it has already developed great strength, and has proved itself to possess two very essential qualities in any breech-loading system, viz:

1. Longitudinal strength.
2. Safety of breech mechanism.

For want of the latter quality the British Government abandoned a system of breech-loading ordnance into which they had largely entered and returned to muzzle-loaders. Next to the vitality of the tube, it certainly is a most essential point, and every reliance can be placed on the screw-breech.

The following measurements of the steel tube were taken after the proof-firing:

	Below rifling.	Between lands.
	Inches.	*Inches.*
Diameter of finished tube	6.60	6.40
Diameter after 247 rounds	6.609	6.409

In addition to its strength and safety of breech mechanism, the ease with which it can be worked by a few men, its ability to stand rough usage in all kinds of weather, and the comparative cheapness of construction, are strong points in favor of this method of conversion. By extending the length of the screw-thread and re-enforce portion of the tube, as has been done in later designs, a much greater support to the tube has been obtained and its strength increased.

Very respectfully, your obedient servant,

F. J. HIGGINSON,
Commander, U. S. N., Inspector of Ordnance.

Commodore W. N. JEFFERS, U. S. N.,
Chief of Bureau of Ordnance, Navy Department, Washington, D. C.

DIRECTIONS FOR THE USE OF THE INTERNAL SPIRAL PRESSURE-GAUGE.

BY LIEUT. B. H. BUCKINGHAM.

The set is composed of two gauges, one of quarter-inch area, and the other of half-inch area; two formers, to fit in the head of the pistons, to be used in putting on the leather packing-rings; two punches, for cutting the holes in the packing-rings, and a wrench.

The disks are of pure rolled copper, carefully gauged to size and annealed.

The curve is made to correspond with the disks sent. It is not absolutely safe to use this curve with disks made at another time, but a new curve should be made for each set of disks.

The sets are lettered and the gauges in the set are numbered, as it is necessary to keep a record of each piston. The housings are lettered and numbered to correspond. The half-inch-area piston should be used for the lower pressures up to 20,000 pounds per square inch, though it will record to 40,000 pounds; the quarter-inch-area piston for the higher pressures from 20,000 pounds and upward, and it will record to 100,000 pounds.

To use the gauge.

With the wrench screw out the base-tap, and then push out the piston from the top. It will not go out the wrong way, owing to the shoulder on the small one and in the housing of the large one. These shoulders are useful in preventing the pistons from flying out from the jar of recoil or the pressure of the gas should it leak behind it, or the suction of the vacua in the waves of pressure, as is sometimes said to be the cause of this action. The piston will occasionally come out hard, owing to the residuum, but when cleaned it should go back with little force, not above four or five pounds. When the gauge is apart, thoroughly clean it, both inside and out, with alcohol or oil. This is very important. When clean, oil well the piston, the packing-ring, and the cylinder. Neat's-foot oil is the best, tallow next.

Push the piston home and center a clean disk over the spiral. Screw the base-tap home, the slopes of which will center the disk. Turn the gauge over and push the piston firmly down upon the disk, so that the error of its momentum will be minimum. Then fill up the space on top of the piston with tallow or oil it well. Tallow or oil well the outside thread, and screw it home to its place with the face of the piston opposite the pressure-chamber. Grease should not be spared, as it, in itself, is an excellent packing. The air-hole in the base-tap should communicate, if possible, with the air, so that the pressure of any gas leaked by the packing will be lessened by expansion. After the pressure is taken, take the gauge apart immediately and examine the piston to see if streaks of residuum indicate that the gas has passed the packing, also the disk to see if it is discolored or blued by gas, thus indicating leak. Should a leak be noted, the fault will lay with the packing most generally. Examine this carefully with a glass; if there be flaws, see if they extend across the face of the ring, or see if the surface of the ring is below the line of the piston. In either case the ring must be changed. To do this, cut out the old one, taking care not to scratch the surface of the piston or the score.

To prepare a new ring.

This is a most important element of the successful working of the gauge, for if the ring is in good order and the gauge clean, reliable results may be counted on.

Select a good piece of fine sole-leather, of firm fine grain, which will stretch well without cracking, but of an elasticity which will prevent a permanent stretch when dry. Cut a piece not less than three inches in diameter, soak it well in warm water and work it soft and pliable. Then with a punch cut a hole in the center. Ship the former on the piston and set the leather firm and square on it by hand. Invert the piston over a hole in a block of wood, with the head of the former entered into the hole, which should be a little larger than the exterior of the piston. Strike the base of the piston a sharp blow with a wooden mallet, thus forcing the packing quickly into its groove. Slow forcing is apt to stretch permanently the leather. See it well worked into the groove.

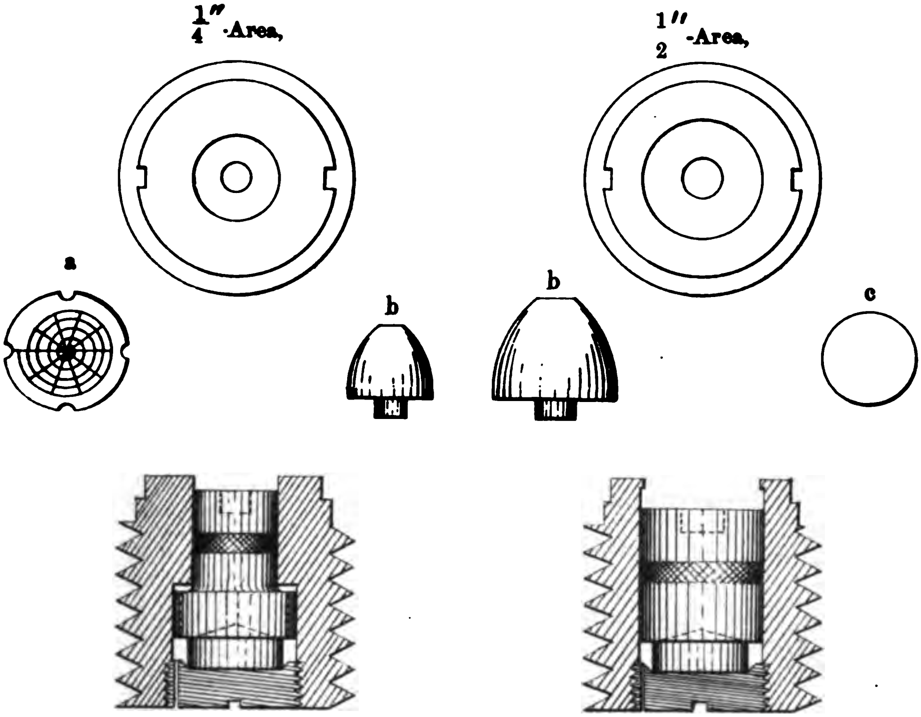
Take it to a vise and work around the circumference by squeezing the leather between the jaws of the vise. Take about half-inch nips the first round, and then spirally work in until the vise touches the piston. Let the leather then stand for several hours to slowly and perfectly dry. Then with a very sharp leather knife cut the leather off clean and smooth, even with the surface of the piston.

If carefully used, *i. e.*, well cleaned and greased between each fire, they will stand many fires, but with bad care they will soon wear out.

To read the disk.

Commence at the heavy radial cut and count the ridges of the thread, then to the right the radial divisions to the end of the impression. The ridges will give the number of turns and the divisions the tenths.

SPIRAL PRESSURE GAUGE.

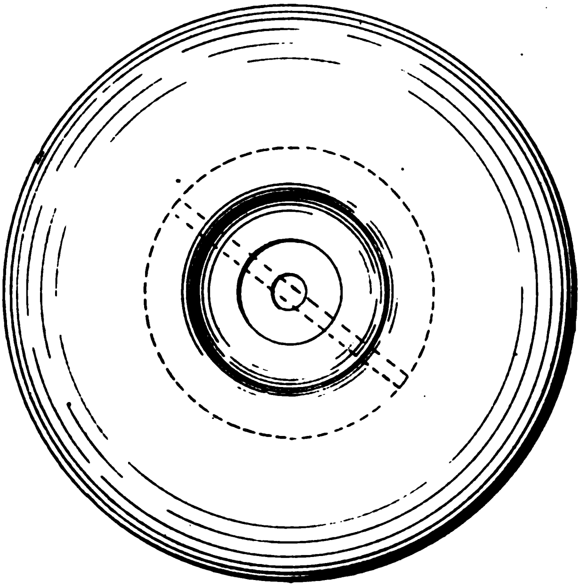


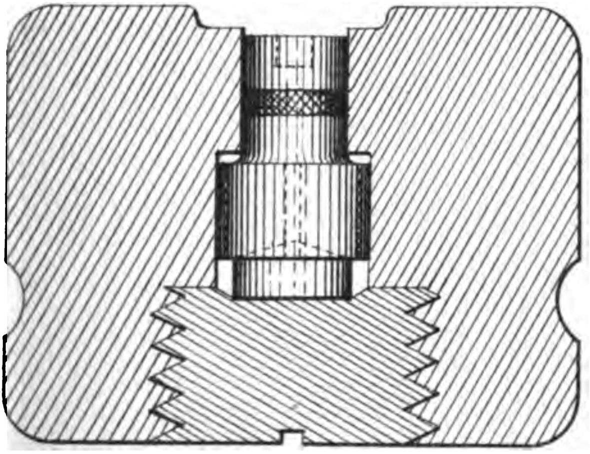
a, FACE OF PISTON; *b b*, FORMERS; *c*, PRESSURE DISC.

The Heliotype Printing Co. 220 Devonshire St Boston

UNIV. OF MICH.

INTERNAL SPIRAL PRESSURE GAUGE.





The Heliotype Printing Co. 220 Devonshire St. Boston

UNIV. OF MICH.

Table of velocities, pressures, and of useful effect of the VIII-inch muzzle-loading rifle, obtained during proof-trial, West Point Foundery, Cold Spring, N. Y., April, 1877.

Powder.		Cartridge.		Volume of powder-chamber.	Density of the charge. $\frac{B}{C}$	Weight of the projectile.	Number of fires from which mean was taken.	Initial velocity.		Pressure.	
Kind.	Weight.	Length.	Diameter.					Mean. *v*.	Difference.	Mean. *D*.	Difference.
	Lbs.	*Inch.*	*Inch.*	*Cubic inch.*		*Pounds.*		*Foot-seconds.*	*Foot-seconds.*	*Pounds per square inch.*	*Pounds per square inch.*
Hexagonal	20	15	7.15	702.15	.85776	180	25	1,141	62.9	18,592	1,424
Hexagonal	35	24	7.15	1,154.53	.83468	180	35	1,475	36.2	25,855	2,878
Cubical	20	15	7.15	702.15	.85776	180	20	1,121	55.7	26,915	3,000

Powder.		Cartridge,		Energy.						Momentum of gun.	Initial velocity of recoil of gun and carriage.
Kind.	Weight.	Length.	Diameter.	Muzzle. $E=\frac{wv^2}{2g\times 2240}$	Per pound of gun. $\frac{E}{P}$	Per pound of powder. $\frac{E}{p}$	Per atmosphere of pressure. $\frac{E\times 14.69}{D}$	Per inch of shot's circumference. $\frac{E}{\pi d}$	Utilized percentage of charge. $\frac{\text{Realized energy.}}{\text{Cal. maximum.*}}$	$\left(m+\frac{\mu}{2}\right)v$	$\frac{\left(m+\frac{\mu}{2}\right)v}{m'+m''}$
	Lbs.	*Inch.*	*Inch.*	*Foot-tons.*	*Foot-tons.*	*Foot-tons.*	*Foot-tons.*	*Foot-tons.*	*Per cent.*	*Foot-pounds.*	*Foot-seconds.*
Hexagonal	20	15	7.15	1,626	.094	81.3	1.29	65.13	73	6,958	10.3
Hexagonal	35	24	7.15	2,718	.158	77.7	1.54	108.84	83	9,350	13.8
Cubical	20	15	7.15	1,569	.091	78.5	0.86	62.87	70	6,836	10.1

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* See Treatise on Construction of Ordnance, London, 1877, page 352 *et seq.*

Projectile, Parrott or Butler shell; length, 20 inches; diameter, 7.95 inches; area of cross-section, 49.64 square inches; length of bore in calibers, 16; volume of bore, 6,392.63 cubic inches; volume of 20 pounds of hexagonal powder, 602.27 cubic inches, space to the pound, 30.113 cubic inches, total volumes in bore (grav. density=1), 11.539 cubic inches; volume of 35 pounds hexagonal powder, 963.64 cubic inches, space to the pound, 27.53 cubic inches, total volumes in bore (grav. density=1), 6.5937; volume of 20 pounds cubical powder, 602.27 cubic inches, space to the pound, 30.113, total volumes in bore (grav. density=1), 11.539; tension of atmosphere, 14.69 pounds; weight of gun, 17,230 pounds; weight of top-carriage, 3,810 pounds.

B = volume of powder in charge; *C* = volume of the section of bore occupied by the charge; *D* = pressure per square inch in bore; *E* = muzzle-energy of the projectile; *m* = mass of projectile; μ = mass of charge; *m'* = mass of gun; *m''* = mass of top-carriage; *P* = weight of gun; *p* = weight of charge; *d* = diameter of projectile; *v* = initial velocity of projectile; *W* = weight of projectile.

Table of velocities, pressures, and useful effects of the 80-pounder breech-loading rifle, West Point Foundery, Cold Spring, N. Y., April, 1877.

Powder.		Cartridge.		Volume of powder-chamber.	Density of the charge. $\frac{B}{C}$	Weight of the projectile.	Number of fires from which mean was taken.	Initial velocity.		Pressure.	
Kind.	Weight.	Length.	Diameter.					Mean. v.	Difference.	Mean. D.	Difference.
Scaghticoke rifle	*Lbs.* 10	*Inches.* 11.5	*Inches.* 5.5	*Cubic inches.* 382.41	0.7145	*Pounds.* 80	50	*Foot-seconds.* 1,252.8	*Foot-seconds.* 45	*Pounds per square inch.* 15,700	*Pounds per square inch.* 900

Powder.		Cartridge.		Energy.						Momentum of gun.	Initial velocity of recoil of gun and carriage.
Kind.	Weight.	Length.	Diameter.	Muzzle. $E=\frac{wv^2}{2g\times 2240}$	Per pound of gun. $\frac{E}{P}$	Per pound of powder. $\frac{E}{p}$	Per atmosphere of pressure. $\frac{E\times 14.69}{D}$	Per inch of shot's circumference. $\frac{E}{\pi d}$	Utilized per cent. of charge. $\frac{\text{Realized energy.}}{\text{Cal. maximum.*}}$	$\left(m+\frac{\mu}{2}\right)v$	$\frac{\left(m+\frac{\mu}{2}\right)v}{m'+m''}$
Scaghticoke rifle	*Lbs.* 10	*Inches.* 11.5	*Inches.* 5.5	*Foot-tons.* 871.22	*Foot-tons.* .086	*Foot-tons.* 87.12	*Foot-tons.* .815	*Foot-tons.* 43.67	*Per cent.* 73	*Foot-pounds.* 3,310	*Foot-seconds.* 9.14

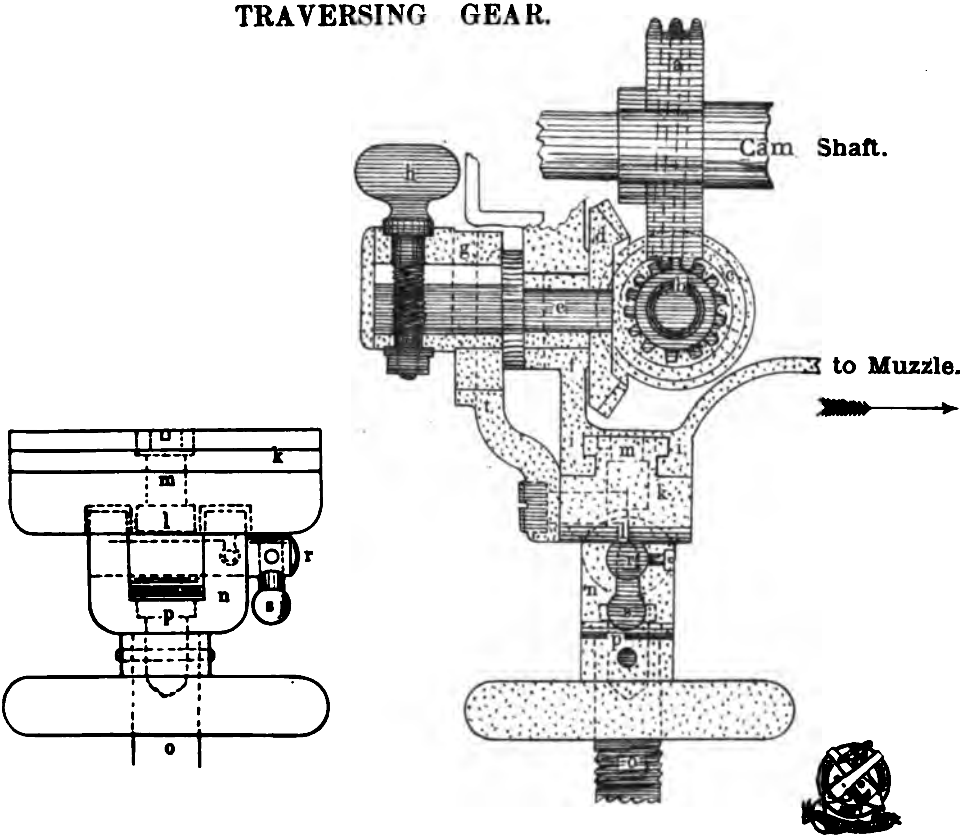
* See Treatise on Construction of Ordnance, London, 1877, page 352 *et seq.*

Projectile, Parrott; length of bore, in calibers, 19.7; diameter of bore, 6.4 inches; volume of bore, 4,070.5 cubic inches; volume of 10 pounds rifle-powder, 273.23 cubic inches; space to the pound, 27.3 cubic inches; total volumes in bore (grav. density = 1), 14.749; tension of atmosphere, 14.69 pounds; weight of gun, 10,150 pounds; weight of carriage, 1,500 pounds.

B = volume of powder in charge; C = volume of section of bore occupied by the charge; D = pressure per square inch in bore; E = muzzle energy of projectile; m = mass of projectile; μ = mass of charge; m' = mass of gun; m'' = mass of carriage; P = weight of gun; p = weight of charge; d = diameter of projectile; v = initial velocity of projectile; w = weight of projectile.

SECTION OF LOWELL BATTERY GUN. Fig 1.

TRAVERSING GEAR.



THE HELIOTYPE PRINTING CO. [illegible] DEVONSHIRE ST BOSTON

Comparison of pressures taken with a Rodman cutter and a spiral impressor, West Point Foundery, Cold Spring, N. Y., July, 1877.

Powder.		Cutter or impressor.	Weight of projectile.	Number of rounds from which mean was taken.	Mean pressure.		Remarks.
Kind.	Weight.				Pounds.	Atmospheres.	
	Lbs.		*Lbs.*				
Hexagonal...	20	Rodman	180	11	22, 971	1, 562. 6	In getting the mean, results which differed by more than twice the mean difference were rejected.
Hexagonal...	20	Spiral	180	11	17, 736	1, 206. 5	
Hexagonal...	35	Rodman	180	10	33, 030	2, 247. 0	
Hexagonal...	35	Spiral.......	180	10	27, 674	1, 882. 5	

Pressure of atmosphere, 14.7 pounds.

Average difference between Rodman cutter and spiral impressor, 5,285.5 pounds, or 359.5 atmospheres.

Respectfully submitted.

F. J. HIGGINSON,
Commander, U. S. N., Inspector of Ordnanec.

CHICOPEE, MASS., *June* 28, 1877.

SIR: In obedience to the order of the department of May 31, I came to this place on June 4, and inspected the five Lowell battery-guns being here constructed for the Navy.

The guns, successively, were subjected to a firing-test, the whole firing being prolonged through several days.

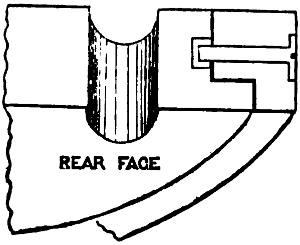
Since the Lowell battery-gun was last reported on by a board of naval officers, it has been changed in several particulars. The traversing-mechanism has been entirely changed. At present the lateral motion is effected as follows: On the cam-shaft, within the "box," or mechanism-casing, a worm, *a* (Fig. 1), is fitted, which engages a worm-wheel, *b*, of 14 teeth, mounted on a transverse horizontal axis, which has bearings for it cast within and at the sides of the "box." This shaft, near its left end, carries a bevel-wheel, *c*, of 22 teeth, which in turn engages a larger bevel-wheel, *d*, of 37 teeth, placed in the transverse vertical plane on a shaft, *e*, which is parallel to the axis of the piece. The shaft passes out to the rear through the breech-plate, *f*, where it has a long bearing, and has near its outer end an eccentric collar, *g*, with a set-screw, *h*, by which the throw of the eccentric can be adjusted, at pleasure, to give the gun a lateral play, varying from 0° to 1° 24′ on each side of the axial line of the piece.

In the rear lower side of the box a lug, *i i*, is cast, its rear face being flush with the breech-plate, while its bottom face is finished up and has a groove cut transversely entirely across it. The lug rests upon a traverse-block, *k*, a finished bronze casting, from whose upper face a T-shaped tongue projects, fitting into and playing in the groove of the lug. To the traverse-block another lug, *l*, of steel is fitted, held to the block by a through-screw, *m*, and having a slight play. A yoke, *n*, is keyed on the top of the elevating-apparatus, *o*, the key, *p*, turning in the yoke, while its lower end is held rigidly in the elevator. This yoke, *n*, is in turn keyed to the steel lug *l* on the bottom of the traverse-block, by means of a locking-pin, *r*, with a lever-head, the end of the lever, *s*, being weighted to make it hang vertical and keep the pin locked. When it is desired to shift the gun from one mounting to another this locking-pin is pulled out, freeing the traverse-block from the elevating-apparatus. From the rear face of the traverse-block, and firmly screwed to it, a bronze arm, *t*, projects aft and upward, its upper end being forked, the fork embracing the eccentric collar.

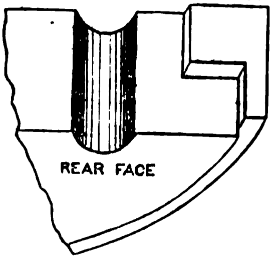
When the crank is turned it revolves the cam-shaft, by suitable gearing, three times for every full turn of the crank. The worm on the cam-shaft drives the bevel-wheels, the larger of which carries with it in its revolutions the eccentric collar; and when the eccentric is set, by means of its adjusting-screw, with any throw, it, acting upon the forked arm connected with the traverse-block, causes the breech of the gun to move slowly backward and forward, from right to left, in the horizontal plane, about twelve shots being delivered while the muzzle is moving once from right to left.

The composition rails, supporting the barrels, which were cast in one with the "box," have been superseded by steel rails, similar to those on the Gatling gun, which are secured to the sides of the "box"; and the manner of supporting the barrels, as well as the method for revolving them, has also been changed.

The four barrels belonging to this gun are grouped around an imaginary central axis, and held in place by insertion into circular brass disks near the forward and at the after ends. These disks revolve in rings which fit smoothly to their circumferences, each disk and its ring being matched together. The disk and ring for the forward ends of the barrels are joined together somewhat as shown here, a longitudinal space being left between the disk and the ring, to accommodate any throwing forward of the disk by the expansion of the barrels in firing. The individual barrels also fit loosely in this disk. The ring hangs on horizontal trunnions, which, passing through holes in the rails near their forward ends, enter sockets in the rings.



The ring and disk for the rear ends of the barrels are fitted as here shown, the disk having a groove cut around it to take the ends of screws placed at intervals through the ring, their inner ends traveling in the groove. The barrels are screwed into this disk, projecting slightly beyond its rear face, where their edges are rounded off. The ring of this disk fits upon a bearing-seat in the rails, just forward of the carrier-rolls, whose cover shuts down on two studs projecting from the rear of the ring, thus locking the rear end of the group of barrels in place. To throw up the barrels it is only necessary to lift the cover, and raise them out of their seat by the lever-handle hereafter to be described. (See No. 1, Fig. 2.)



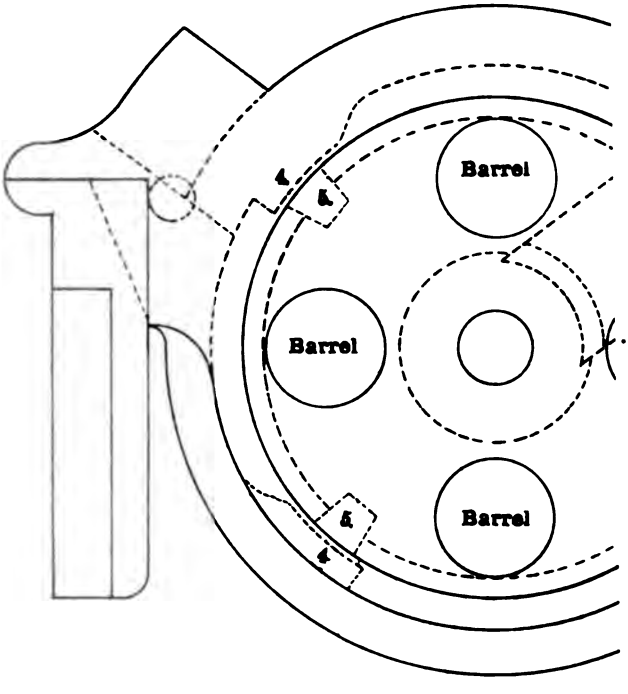
The group of barrels, supported in these two places, can be revolved around its imaginary central axis, the latter being placed at such a height relatively to the loading mechanism that the revolution of the barrels brings any desired one to the loading-position.

At present, the revolution of the barrels is accomplished by a short lever, No. 1 (fig. 2), the heel engaged at the center of the after barrel-disk and the handle projecting conveniently above the gun, the shank coming between the rear of the disk and the cover for the carrier-rolls. This lever has a spring-paul, 3, passing down through the center of its handle, the lower end of the paul bearing by spring pressure upon the face of the slot, 4, cut in the circumference of the disk, while the upper

SECTION OF LOWELL BA

METHOD OF REVOLVING THE

(View From the Fro



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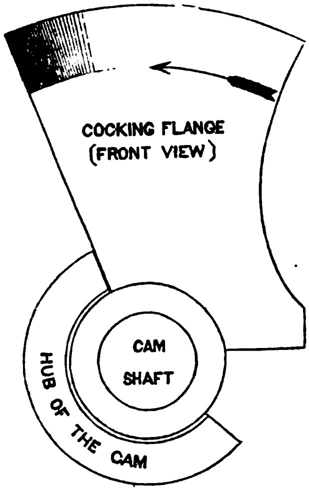
end of the paul passes out through the lever-handle, so that should the paul be left up through any defect in its spring, it may be forced down by hand. No. 2 is a spring-catch extending down through the ring and fitting into holes or sockets, 5, in the disk. These holes are properly spaced for clamping the barrels in front of the lock.

When it is desired to revolve up a new barrel for firing, the lever 1 is pulled across the group of barrels, to the left in the figure, but to the right when facing the muzzle of the gun. As it moves across the shoe 7, which is fast to the lever, in passing the spring-catch, 2, raises it by passing under its beveled head, 6, and frees it from the hole 5, in the disk. While the catch is thus raised the paul 3 takes against the side of the slot 4, and the progressive motion of the lever to the left revolves the group of barrels. In the mean time the shoe 7 has passed beyond the head 6 of the catch, and has permitted the catch 2, by the pressure of its spring, to bear upon the outer face of the disk. When the lever 1 has traversed the space between the rails, it has so far revolved the barrels that a new hole, 5, is under the catch 2, and the catch is forced by its spring into it, at which point the new barrel is in the firing position. The lever is then pushed back to its original position, the paul 3 riding up the incline of the slot 4, without disturbing the barrels. The shoe 7, in going back, rides over the head of the catch 2, and forces it into its socket, if not already there.

Some slight changes have been made in the method of moving the lock by the cam. Heretofore the cam had a flange on it which worked between two studs on the lock, by which the lock was alternately moved backward and forward. Now the same motion is obtained by having one stud on the lock, which fits into a groove in the flange on the cam; also the cocking-flange, which was formerly a part of the cam, is now made separate. It is shaped somewhat as given in the illustration.



The front hub of the cam is partly cut out; the cocking-flange, of steel, which has the same radius as the cam, goes into this cut, whichit nearly fills, and is secured to the cam-shaft, while the cam plays loosely upon it. Now when the cam-shaft is revolved it carries with it the cocking-flange, whose side, taking against the face of the cut in the hub, causes the cam also to revolve. As the hub-cut is larger than the cocking-flange where the flange passes through it, there is a slight loss of motion in the cam when the crank is reversed. This is given, so that if the shaft is reversed in its motion immediately after the gun is fired, the cocking-flange may be thrown back before the cam begins to reverse, and thus insures the flange getting in, abaft the cocking-stud, before the lock is drawn at all to the rear. The part marked *x* is cut to conform to the groove in the cam-flange. The revolution in firing is in the direction of the arrow. The form of the firing-pin has been slightly altered in shape, to guard against destructive vibrations.

The "feeder" for use with cartridges packed in paper boxes, and the feed-port, with the arrangement for closing it, are the same as when the gun was last reported on. During the trial a new "feeder," of the same general shape as the old one, but intended to be used with cartridges carried in tin holders or boxes, was presented for trial by the exhibitors of the gun; but, as will be seen in the notes in the firing-record, it was so unsatisfactory in its performances, from causes there set forth,* that it was withdrawn; and neither the feeder nor the cartridges in tin holders were again presented for trial.

The sights for the Lowell battery-gun are placed at the side, the front sight being secured to the outer face of the right barrel rail, near its forward end. Its upper edge is as high as the axis of the firing-barrel. The target sight is contained in a case, which is screwed to the rear end of the right rail abreast the breech-plate. This sight has one movement only, that in the vertical plane, when the gun is level, and is clamped in position by a spring. The vertical plane through the sights is said to be parallel to the vertical plane through the axis of the firing-barrel.

So far as I could ascertain, the tripod mounting for this pattern of gun is substantially the same as that exhibited at the naval experimental battery in October last. The inventors have, however, designed a field-carriage, upon which the guns were mounted during a part of the firing. The carriage, and also the tripod mounting, are shown in the accompanying photographs furnished to me by the exhibitors of the gun. As will be seen in both mountings, the gun rests on a heavy saddle or trunnion seat, which, in turn, rests upon the usual "tail" piece. In the field-carriage this "tail piece" fits down on a pivot cast on the top of the sphere, which, with a shell described below, forms a ball-and-socket joint. The ball, in this case, has a feather running around its under side, opposite the pivot, and is embraced by a hemispherical cast iron shell, cast in two parts, with flanges for uniting them, in which a score is left for the feather. The ball and interior ofthe shell are finished up smooth and the parts are united. The shell is then keyed by another flange to the under side of the table of the carriage, through which it partly projects. On the outside face of the feather teeth are cut, into which the thread of a worm-screw plays. The worm-screw, with a disk head, is seen on the right in the picture. This screw gives the sphere a revolution in the vertical plane parallel to the axle of the field-carriage, while the feather holds the ball rigidly against motion in any other direction. This attachment is provided that the axis of the trunnions may be leveled whenever, from the roughness or inclination of the ground, the carriage-axle has one end raised higher than the other. It also serves to accommodate the dispersion of the fire to the inclination of a slope that it may be desired to sweep.

The table above spoken of is the flat part of the carriage under the gun. Its arms embrace the axle of the carriage as hinges, while at its rear end it has "swords" extending down through the trail-piece, to which they are pinned. By removing the pins the table can be tipped forward or lowered at pleasure, at the same time rapidly changing the elevation of the gun. It was with a view to obtaining a wider range of elevation than could be given by the ordinary elevating apparatus, and as a means of rapidly changing the elevation, that led to the adoption of the table.

The only remaining distinctive feature of this field-carriage to be described is the method for transporting ammunition. The crates for this purpose are made of bronze, firmly secured to the axle, and are further braced with angle-irons coming back on and bolted to the arms of the trail. These two crates stand on each side of the gun, and are designed to carry in each three boxes of ammunition, each box to contain five hundred rounds, when packed in the new tin holders. They

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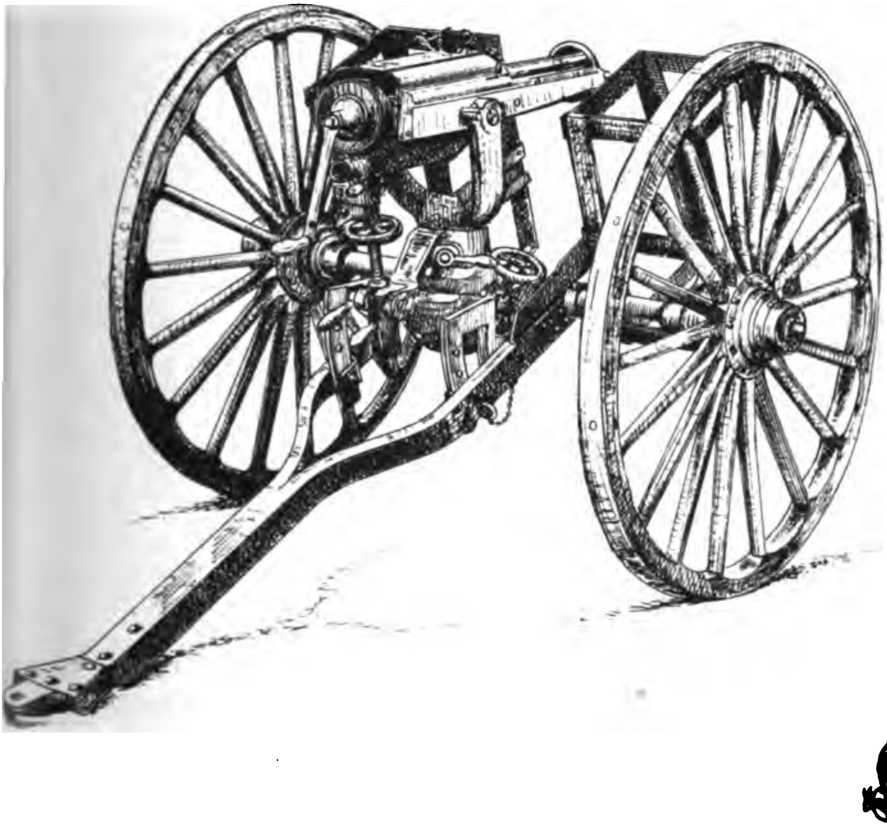
* The firing-record is replaced by the one made by the gun when firing for endurance, which is thought to be more interesting.

LOWELL BATTERY GUN.



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UNIV. OF MICH.

will not contain so many when packed in the paper boxes or holders heretofore used with this gun. It is intended to feed the gun directly from the boxes in the crates, for which they are very conveniently placed. As the crates show in the picture, they interfered with the traverse of the gun when the axis of the trunnions and the axle of the carriage were not nearly parallel; and to remedy this the crates were cut down before I left Chickopee, but without impairing their capacity. This alteration gave sufficient play when the top box of ammunition was removed.

I append some weights, dimensions, &c., of the gun, as near as I could arrive at them with the implements at hand.

Weight of tripod with saddle on it and elevating apparatus attached	125 pounds.
Weight of field-carriage with saddle on it, and elevating apparatus attached, crates empty	434 pounds.
Weight of Lowell battery-gun without feeder	142 pounds.
Weight of feeder when empty	3 pounds.
Preponderance of gun on trunnions as mounted, feeder on	5 pounds.
Weight lifted in moving gun up for quick depression	24 pounds.
Weight of elevating apparatus	8 pounds.
Length of gun from muzzle of the barrels to inside edge of crank	35.9 inches.
Projection of crank to rear	3.75 inches.
Distance between sights	29.6 inches.
Total length of barrel	18.1 inches.
Thickness of barrels at breech	0.33 inch.
Caliber	0.50 inch.
Depth of chamber	1.7 inches.
Diameter of chamber	0.57 inch.
Extreme elevation on tripod, tripod head level	25°
Extreme depression on tripod, tripod head level	34°
Extreme lateral train given by traversing gear on each side of axial line.	1° 24′
Extreme elevation on field-carriage, table down	40°
Extreme depression on field-carriage, using table	42°
Axle level, tip of the gun in transverse plane from the vertical	13°
On field-carriage, gun revolves on its pivot when level, crates empty	21°
Weight of empty ammunition-box with cover	6 pounds.
Weight of empty ammunition-box cover	1.5 pounds.

I inclose with this report, for the information of the bureau above, a sectional view of the Lowell battery-gun, showing the arrangement of its parts, taken, by permission of the inventors, from the drawings of a small model gun. I also inclose tracings of the lock, full size, in plan and in elevation.

I am, sir, very respectfully, your obedient servant,

A. H. McCORMICK,
Commander, United States Navy.

Commodore Wm. N. Jeffers, U. S. N.,
Chief of the Bureau of Ordnance,
Navy Department, Washington, D. C.

Record of firing Lowell battery-gun No. 105, *Naval Experimental Battery, July,* 1877.

	Times.	Number of cartridges fired.	Remarks.
	h. m. s.		
			JULY 13.—Lowell battery-gun No. 105 was mounted on its field-carriage in front of the firing-butt. To use ammunition from the United States Cartridge Company's factory at Lowell, Mass., originally loaded in 1873; reloaded in 1874; reloaded in April, 1875. These cartridges are center-primed, caliber .50, the ball weighing 450 grains, and the powder 70 grains. Weather hot; wind to right of line of fire and light. Gun level; traverse on full. Ammunition, in paper cases, is placed in its packing-boxes on top of the carriage-crates; to be fed to the gun by two men, who supply the feeder alternately. Lieut.-Commander Pearson and Mr. Woodworth present to exhibit the gun; examine it and find it in good condition, and mechanism well lubricated.
Commence firing, No. 1 barrel	12 54 30		Firing for endurance.
Stopped to shift barrels	12 57 33		
Resume the firing, No. 2 barrel	12 57 42		Delay, 9 seconds.
Stopped by cartridge exploding in rolls.	12 59 33		Remove one carrier-roll, take out lock, clear shell from extractors, clear the ball from the barrel with a rod from the muzzle; replace parts.
Resume the firing with No. 2 barrel	1 00 40		Delay, 67 seconds.
	1 02 00	1,620	
Stopped to shift barrel	1 03 15		
Resume firing, No. 3 barrel	1 03 17		Delay, 2 seconds.
Stopped to shift barrel	1 06 15		
Resume the firing, No. 4 barrel	1 06 20		Delay, 5 seconds.
Exchanged man at crank	1 08 00		No delay.
Stopped to shift barrels	1 09 26		
Tried to resume firing, No. 1 barrel.	1 09 40		Opened the case and found the lock jammed. Clear it. Whole delay, 99 seconds.
Resume the firing, No. 1 barrel	1 11 05		
Jammed	1 11 30		Took out lock, to which a fired shell was held. Found that the firing-pin was set tight, by the shell having blown through in the cap. Shift locks. Delay, 70 seconds.
Shift lock and resume firing, No. 1 barrel.	1 12 40		
Jammed	1 15 20		A thick shell which sticks in the barrel. Force it out with a rod from the muzzle. Delay, 25 seconds.
Resume the firing, No. 1 barrel	1 15 45		
Jammed	1 16 00		Gun working very stiff. Cannot extract a shell. Remove lock but can find nothing wrong. Clear shell from barrel. Delay, 129 seconds.
Resume the firing, No. 1 barrel	1 18 09		
Jammed	1 20 50	2,200	Gun is binding where crank goes over crank-stud. Get the crank off the stud with great difficulty. Find the crank-stud roughed up and the bearing of the internal gear-wheel scored. The crank-stud is not hot, but very dry. File parts smooth, and also ease the crank-stud. The thread for the nut of the crank was injured in getting the crank off, and have to take it to the station machine-shop to repair the injury. Having replaced parts and lubricated them well, resumed the firing. Delay, $1^h 8^m 10^s$.
Resume the firing, No. 1 barrel	2 29 00		
Stopped to shift barrels	2 33 00		
Resume the firing, No. 2 barrel	2 33 45		Delay, 45 seconds.
Stopped to shift barrels	2 36 10		No. 2 barrel will not work well; it is thrown out of use altogether.
Resume the firing, No. 3 barrel	2 36 14		Delay, 4 seconds.
Stopped to shift barrels	2 39 20		Gun working very well.
Resume the firing, No. 4 barrel	2 39 26		Delay, 6 seconds.
Stopped to shift barrels	2 40 10		
Resume the firing, No. 1 barrel	2 40 14		Delay, 4 seconds.
Stopped to shift barrels	2 42 55		
Resume the firing, No. 3 barrel	2 43 00		Delay, 5 seconds. Pass by No. 2 barrel.
Stopped to shift barrels	2 45 05		
Resume the firing, No. 4 barrel	2 45 08		Delay, 3 seconds.

Record of firing Lowell battery-gun No. 105, *&c.*—Continued.

	Times.	Number of cartridges fired.	Remarks.
	h. m. s.		
Stopped to shift barrels	2 48 23		
Resume the firing, No. 1 barrel	2 48 27		Delay, 4 seconds.
Stopped to shift barrels	2 50 57		
Resume the firing, No. 3 barrel	2 51 02		Delay, 5 seconds. Pass by No. 2 barrel.
Stopped to shift barrels	2 54 36		
Resume the firing, No. 4 barrel	2 54 40		Delay, 4 seconds.
Stopped to shift barrels	2 58 00		
Resume the firing, No. 1 barrel	2 58 05		Delay, 5 seconds.
Stopped to shift barrels	3 01 08		
Resume the firing, No. 3 barrel	3 01 16		Delay, 8 seconds. Pass by No. 2 barrel.
Stopped to shift barrels	3 03 27		
Resume the firing, No. 4 barrel	3 03 31		Delay, 4 seconds.
Stopped	3 07 30		Look and find a thick-headed shell lodged in barrel. Force the crank, which extracts it. Close up and resume. Delay, 30 seconds.
Resume the firing, No. 4 barrel	3 08 00		
Stopped to shift barrels	3 09 10		
Resume the firing, No. 1 barrel	3 09 13		Delay, 3 seconds.
Stopped to shift barrels	3 13 36		
Resume the firing, No. 3 barrel	3 13 41		Delay, 5 seconds.
Ended this series	3 15 42	9,080	At the end of the series find the barrels very hot, but still they revolve easily, and are readily thrown up. The lock and mechanism are warm, but not hot enough to burn the hand. On examination find that a shell with its head pulled off has been left in barrel No. 2; remove it with a shell-extractor after some trouble. The ability to pass by a barrel which has become unserviceable is a good feature of this gun. During this firing the carriage had only a slight tremor, the trail having been stiffened by a brace in the crotch of the fork since it was tried at Chicopee in June last. Lieut.-Commander Pearson left for Washington at 2 p. m.
Total cartridges fired to-day		12,900	
Rate of firing per minute, including stoppages, between 2 hours 29 minutes and 3 hours 15 minutes p. m.		200	
Commenced firing, No. 1 barrel	10 32 35		JULY 14.—Gun No. 105 having been cleaned was again placed before the butte, mounted on its field-carriage. Same ammunition as was used yesterday, in paper cases in boxes on the top of the crates. Weather warm, with light airs. Gun traversing full. Captain Jeffers, Chief of the Bureau of Ordnance, present. Start with two men at the feed and one at the [illegible] the latter to be relieved at intervals. [illegible] endurance of gun, and the speed [illegible] the rate of 250 per minute, if that can [illegible] tained by the man at the crank.
Stopped to shift barrels	10 36 33		
Resumed the firing, No. 2 barrel	10 36 35		Delay, 2 seconds. The feed is shut off when shifting barrels.
Stopped to shift barrels	10 40 02		
Resumed the firing, No. 3 barrel	10 40 04		Delay, 2 seconds.
Stopped to shift barrels	10 44 05		
Resumed the firing, No. 4 barrel	10 44 11		Delay, 6 seconds.
Stopped to shift barrels	10 47 40		
Resumed the firing, No. 1 barrel	10 47 45		Delay, 5 seconds.
Stopped to shift barrels	10 51 31		
Resumed the firing, No. 2 barrel	10 51 37		Delay, 6 seconds.
Stopped to shift barrels	10 54 20		
Resumed the firing, No. 3 barrel	10 54 24		Delay, 4 seconds.
Stopped to shift barrels	10 57 54		
Resumed the firing, No. 4 barrel	10 57 57		Delay, 3 seconds.
End of series	10 59 20	6,030	Gun working well at end of series.
Commence firing for maximum speed.	11 01 12		Resume. Conditions the same as before. Firing for maximum, continuous speed.

Record of firing Lowell battery-gun No. 105, *&c.*—Continued.

	Times.	Number of cartridges fired.	Remarks.
	h. m. s.		
Stopped to shift barrels	11 03 13		
Resumed the firing	11 03 24		Delay, 11 seconds.
Stopped by cartridge exploding in rolls.	11 04 14		Removed rolls; shifted barrels; replaced parts. Ball left in barrel. This was probably a hang-fire. Delay, 52 seconds.
Resumed the firing	11 05 06		
Stopped by cartridge exploding in rolls.	11 05 57		Cleared shell from lock; shifted the barrels Ball left in barrel.
Resumed the firing	11 06 41		Delay, 44 seconds.
Stopped by cartridge exploding in rolls.	11 07 23		Cleared shell from lock; shifted the barrels. Ball left in barrel.
Resumed the firing	11 08 04		Delay 41 seconds.
Ended the series	11 09 08	1,620	At end of series throw up barrels and back the bullets out of them with a rod, the bullets having melted in the mean time. At end of series a cartridge was partly entered in a barrel, and left there to try the effect of the heating on it. When it had remained about 2 minutes it exploded.
Total time consumed	7 56		
Total delays from hang-fires, shifting barrels, &c.	2 28		
Rate of firing, per minute, excluding time consumed by delays.		294	
Commenced firing	11 20 05		Put the "feeder" for use with the cartridges, carried in tin holders or cases, on the gun and started a series to test, in part, the value of the tin cases. Same ammunition as before in tin cases in a box set on top of the left crate. Mr. Graves at the feed.
Stopped	11 20 08		A failure to extract. Back shell out with a rod from the muzzle.
Resumed the firing	11 20 41		Delay, 33 seconds.
Stopped	11 20 50		A failure to extract. Backed the shell out with a rod.
Resumed the firing	11 21 18		Delay, 28 seconds.
Stopped	11 22 26		A failure to extract. On examining the lock found that the extractors were sprung in the shank, probably by the cartridge which was put in the barrel to test the effect of the heating on it, aided by the effect of the different hang-fires.
Resumed the firing	11 29 22		Spring the extractors back with a hammer and resume the firing.
Stopped	11 29 24		Whole delay, 6 minutes 56 seconds.
Resumed the firing	11 29 49		Delay, 25 seconds.
Ended the series	11 31 43	375	So far as the tin cases were concerned this series was quite satisfactory, though with rapid firing one man at the feed could not, we think, keep the gun supplied. At the end of the series Captain Jeffers left, and further firing was postponed until the afternoon. AFTERNOON.—The lock and mechanism of the gun having been partly cleaned and well lubricated, while the barrels had not been touched, the firing was resumed. Weather cooler with a pleasant breeze to the left of the gun. Same ammunition placed in paper cases on each side of the gun. Firing for endurance, and at as rapid a speed as the man at the crank can well maintain.
Commence firing, No. 1 barrel	12 49 00		
Stopped to shift barrel	12 54 07		
Resume the firing, No. 2 barrel	12 54 09		Delay, 2 seconds.
Stopped to shift barrels	12 59 36		
Resume the firing, No. 3 barrel	12 59 40		Delay, 4 seconds.
Stopped to shift barrels	1 03 30		
Resume the firing, No. 4 barrel	1 03 34		Delay, 4 seconds.
Stopped to shift barrels	1 07 18		
Resumed the firing, No. 1 barrel	1 07 21		Delay, 3 seconds.
Stopped to shift barrels	1 12 20		
Resumed the firing, No. 2 barrel	1 12 23		Delay, 3 seconds.
Stopped to shift barrels	1 15 47		
Resumed the firing, No. 3 barrel	1 15 51		Delay, 4 seconds.
Stopped to shift barrels	1 18 50		

Record of firing Lowell battery-gun No. 105, *&c.*—Continued.

	Times.	Number of cartridges fired.	Remarks.
	h. m. s.		
Resumed the firing, No. 4 barrel	1 18 54	....	Delay, 4 seconds.
Stopped to shift barrels	1 23 50	....	
Resumed the firing, No. 1 barrel	1 23 53	....	Delay, 3 seconds.
Stopped to shift barrels	1 29 54	....	
Resumed the firing, No. 2 barrel	1 29 58	....	Delay, 4 seconds. At end of series gun is working well in all particulars. Rate of firing during series, 45 minutes 37 seconds, including all stoppages, 225.3 per minute.
Ended series	1 34 37	10, 275	
			Having consumed the lot of ammunition commenced with, shifted the gun to the left and resumed firing with another lot of United States Cartridge Company's center-primed cartridges, marked, on the wooden packing-boxes, as loaded in April and May, 1874. There are no marks on the paper wrappers. This ammunition in the paper cases is placed in open boxes on the crates. Gun set not to traverse. Two men at feed.
Commence firing, No. 1 barrel	2 07 56	....	
Stopped	2 13 38	....	A failure to extract, though the extractors have cut a groove on each side of the shell-head. Back shell out with a rod; shift barrels.
Resume the firing, No. 2 barrel	2 14 45	....	Delay, 67 seconds.
Stopped to shift barrels	2 17 26	....	
Resume the firing, No. 3 barrel	2 17 29	....	Delay, 3 seconds.
Stopped to shift barrels	2 24 33	....	
Resume the firing, No. 4 barrel	2 24 37	....	Delay, 4 seconds.
Stopped to shift barrels	2 29 06	....	
Resumed the firing, No. 1 barrel	2 29 09	....	Delay, 3 seconds.
Stopped	2 32 52	....	Stoppage caused by a cartridge jamming in the barrel in feeding, the cartridge being too large. Backed it out with a rod; shifted barrels.
Resumed the firing, No. 2 barrel	2 34 05	....	Delay, 73 seconds.
Stopped	2 39 08	....	A failure to extract, though extractors have cut grooves through the shell-head. Backed shell out with a rod; shift barrels.
Resume the firing, No. 3 barrel	2 39 58	....	Delay, 50 seconds.
Stopped	2 43 31	....	Stoppage caused by a piece of shell which was left in barrel. Clear barrel and resume.
Resume the firing, No. 3 barrel	2 43 55	....	Delay, 24 seconds.
Stopped to shift barrels	2 50 49	....	
Resume the firing, No. 4 barrel	2 50 52	....	Delay, 3 seconds.
Stopped	2 52 23	....	A failure to extract; shell-head cut by extractors; throw up the barrels and clear all that need it.
Resume the firing	2 55 34	....	Delay, 3 minutes 11 seconds.
Stopped to shift barrels	3 02 08	....	When No. 1 barrel was revolved up the cartridges jammed in feeding to it, so No. 2 barrel is revolved up and the firing resumed.
Resume the firing, No. 2 barrel	3 02 28	....	Delay, 20 seconds.
Stopped to shift barrels	3 08 58	....	
Resume the firing, No. 3 barrel	3 09 02	....	Delay, 4 seconds.
Stopped by cartridge exploding in rolls.	3 13 40	....	Probably a hang-fire; clear shell from rolls and ball from barrel; revolve up No. 4 barrel and resume.
Resume the firing, No. 4 barrel	3 15 09	....	Delay, 89 seconds.
Stopped to shift barrels	3 23 48	....	
Resume the firing, No. 2 barrel	3 23 51	....	Delay, 3 seconds. Pass No. 1 barrel by and revolve up No. 2.
Stopped to shift barrels	3 29 33	....	
Resume the firing, No. 3 barrel	3 29 37	....	Delay, 4 seconds.
Stopped by cartridge exploding in rolls.	3 33 45	....	Clear shell from rolls and ball from barrels This was probably a hang-fire. Revolve up No. 4 barrel and resume the firing.
Resume the firing, No. 4 barrel	3 34 45	....	Delay, 60 seconds.
Stopped	3 35 28	....	A failure to extract. The extractors have cut grooves in the shell-head. Back shell out.
Resume the firing, No. 4 barrel	3 36 03	....	Delay, 35 seconds.
Stopped	3 37 34	....	Cartridge jammed partly in the barrel in feeding; try to clear, but cannot, as there is danger in trying to force it out from the muzzle; leave it in, and revolve up a new barrel, passing by No. 1.
Resume the firing, No. 2 barrel	3 38 54	....	Delay, 1 minute 20 seconds.

Record of firing Lowell battery-gun No. 105, *&c*—Continued.

	Times. h. m. s.	Number of cartridges fired.	Remarks.
Ended the series	3 41 00	17,820	At the end of the series there is a failure to extract; back the shell out from the muzzle; clear all the barrels and shift the gun to the right. The barrels are very hot, but the lock and mechanism are cool or not warm enough to burn the hand; the barrels are very foul and the mechanism slightly so.
Total time consumed in firing this series.	1 33 04	....	
Total delays in this series	11 51	....	
Rate of firing, including all delays	....	*191	
Rate of firing, excluding all delays	....	*202	
			Prepared to test more fully the working of the new tin feed-cases. Ninety-four of them filled with United States Cartridge Company's center-primed cartridges originally loaded in 1873, reloaded in 1874, and reloaded in April, 1875 were placed in the crate-boxes to be fed alternately to their proper "feeder" by two men, one on each side of the gun; gun level and not traversing.
Commence the firing, No. 1 barrel	3 46 30	....	At the very start a cartridge jammed in the feed-port, the cause not being apparent, unless it was from the fouling which had accumulated during the long-continued firing. Delay in revolving up No. 2 barrel, 3 seconds.
Stopped to shift barrels	3 53 15	....	
Resumed the firing, No. 2 barrel	3 53 18	....	
Ended series and trial of gun	3 54 35	1,410	In entering the feed-case in the "feeder" it is necessary to hold up the ends of the bullets, requiring the use of both hands. The cartridges must then be forced down with the finger out of the feed-case, and the feed-case is removed, the "feeder" is always one-half empty. The necessity for using both hands is objectionable. With great rapidity of fire it would be difficult to keep the "feeder" supplied. At end of trial, gun shows no wear in any of its parts.
Time consumed in this series	8 05	....	
Delays in this series	03	....	
Rate of firing, including delay	....	*175	

* Per minute.

RÉSUMÉ OF FIRING RECORD.

Total number of cartridges fired (of ammunition reloaded in 1875)	32,610
Burst the shell at the side	1,844
Burst in the head	9
Missed fire at the first trial	145
Missed fire at the second trial	130
Total number of cartridges fired (ammunition loaded in 1874)	17,820
Burst the shell at the side	1,924
Burst in the head	0
Missed fire at the first trial	136
Missed fire at the second trial	74
Total number of cartridges fired	50,430

Respectfully submitted.

A. H. McCORMICK,
Commander, United States Navy.
EDWARD W. VERY,
Lieutenant, United States Navy.

NAVAL EXPERIMENTAL BATTERY,
Annapolis, Md., July 16, 1877.

Commodore WILLIAM N. JEFFERS, U. S. N.,
Chief of the Bureau of Ordnance.

Google

No. 219.]

NAVAL EXPERIMENTAL BATTERY,
Annapolis, Md., July 28, 1877.

SIR: I have the honor to inclose the table and formula for the elements of the trajectory of the Lowell battery-gun. They are worked entirely by theory and have been checked by a series of firings. The result of the firings is as follows:

Against a wind nearly ahead, of a force of about three miles per hour:

100 yards	16′ 12″	500 yards	1° 27′ 07′
200 yards	31′ 49″	600 yards	1° 55′ 46″
300 yards	47′ 18″	700 yards	2° 29′ 24″
400 yards	1° 05′ 06″		

Against a wind directly ahead, of a force of about five to six miles per hour:

300 yards	0° 35′	800 yards	3° 00′
400 yards	1° 10′	900 yards	4° 15′
500 yards	1° 25′	1,000 yards	4° 40′
600 yards	2° 30′	11 yards	5° 10′
700 yards	2° 40′		

There was considerable variance in the results, owing to the jarring of the gun in volley-firing. The method of fastening the gun by the clamp for lateral movement is defective, as, notwithstanding its being set as taut as possible by hand, the resistance of the bullets to the rifling caused the gun to turn to the left. In a single volley of fifteen shots the point of impact of the last would be about 8 feet to the left of that of the first at 100 yards. The clamp, however, never worked slack.

I have to report the breaking of one of the extractor hooks of the lock. It had stood about 52,000 rounds, and was broken about a half inch from the end, by a hang-fire. The cartridge was entirely in the rolls, and the case was unsupported. The fracture was clean, and from its looks I do not think that the metal had been weakened before. Another hook can easily be supplied, and as they take but little room I recommend that each spare lock be provided with two spare hooks, which can easily be shipped, and which are the only parts of the lock liable to be broken.

I also recommend that in any instructions sent out with the gun, a caution be inserted, that when a stoppage occurs and the barrel be jammed so that it cannot be shifted, the operator, *before uncovering the rolls*, should back the crank carefully, looking down through the aperture behind the barrels until he sees the cartridge in the rolls, which brings the lock clear of them; then raise the cover and remove the lock before making any attempt to clear the obstruction. The extractor grasps the cartridge while pushing it forward, and there is great danger of giving the crank a slight turn ahead after the covers are raised and the cartridge exposed, causing the firing-pin to explode the cartridge, when the bullet might strike the barrel-frame and would certainly spatter lead all about the gun.

I am, sir, very respectfully, your obedient servant,

EDWARD W. VERY,
Lieutenant and Inspector of Ordnance.

Commodore W. N. JEFFERS,
Chief of Bureau of Ordnance.

Forwarded.

C. R. P. RODGERS,
Rear Admiral, Commanding.

Elements of the trajectory of the Lowell gun.

Range.	Remaining velocity.	Time of flight.	Elevation.			Height of rear sight.	Drift.	Dangerous space for infantry.	Energy of bullet.	Ordinates of 1,100 yards trajectory.
Yards	*Feet.*	*Sec.*	°	′	″	*Inches.*	*Feet.*	*Yds.*	*Ft. lbs.*	*Feet.*
0	1,300	.0000	0	0	0	.0000	.0	580	1,690	0
100	1,115	.2485	0	11	22	.0979	.5	556	1,243	20
200	976	.5272	0	25	36	.2204	1.0	247	952	35
300	868	.8302	0	42	20	.3644	2.0	140	753	53
400	781	1.152	1	01	12	.5268	3.3	90	610	61
500	710	1.491	1	21	54	.7052	4.3	68	504	65
600	651	1.846	1	44	38	.9011	6.0	49	424	69
700	600	2.210	2	08	32	1.1073	8.5	41	361	67
800	559	2.580	2	33	16	1.3205	10.0	35	312	56
900	521	2.963	2	59	39	1.5481	12.5	30	271	42
1,000	489	3.352	3	27	06	1.7823	15.0	22	239	24
1,100	460	3.750	3	55	43	2.0279	18.0	18	212	0

FORMULAS USED IN THE COMPUTATIONS.

Remaining velocity.

$V' = \frac{V}{1 + cVx}$
V' = remaining velocity.
V = muzzle velocity (1,300 feet).
x = range.
$c = b\frac{r^2}{w}$
b = .000062.
R = radius of bullet in feet (.021).
W = weight of bullet in pounds (.0643).

Drift.

Estimated from actual firing on the range.

Marks on the light bar.

$M = a + b$.
M = total height necessary to raise bar.
a = height of front sight above trunnion level.
b = depth of rear sight below trunnion level.
$a = l$ tang. a.
l = distance between center of trunnion and center of rear sight notch.
a = angle of elevation.
$b = l'$ tang. a.
l' = distance between center of trunnion and upper point of front sight.

Time of flight

$T = \frac{x}{V''}$
T = time of flight.
x = range.
V'' = mean velocity $= \frac{1}{2}(V + V'.)$

Angle of elevation.

Tang. $a = \frac{s}{x}$
a = angle of elevation.
x = range.
s = drop of bullet due to gravity.
$s = \frac{1}{2} g t^2$.
g = gravity = 32.155 feet.
t = time of flight.

Energy of bullet.

$E = \frac{W V'^2}{2g}$.
E = energy in foot pounds.
W = weight of bullet in pounds.
V' = velocity at range.
g = gravity (32.155).

Dangerous space for infantry.

$D = h$ cotang. a.
D = dangerous space.
h = average height of man (5′.5).
a = angle of fall of bullet.

Ordinates of 1,100 yards' trajectory (measured from constructed trajectory.)

To construct the trajectory.

Lay off the desired range, and at the extremity erect a perpendicular equal in length to the fall of the projectile due to gravity during the extreme time of flight. Draw a hypotenuse to the triangle, and on the base erect perpendicular cutting the hypotenuse. From the hypotenuse measure on the perpendiculars the lengths of fall due to gravity for the time of traversing each hundred yards. The curve passing through these points will be the trajectory required.

Weight of bullet, 450 grains.
Muzzle velocity, 1,300 feet.

Horizontal distance from center of rear sight to center of trunnions, 11.04 inches.

Horizontal distance from rear of front sight to center of trunnions, 18.56 inches.

Height of center of muzzle when level, above solid platform, 42.25 inches.

Height of center of trunnions above platform, 39.7 inches.

EDWARD W. VERY,
Lieutenant and Inspector of Ordnance.

UNITED STATES TORPEDO STATION,
Newport, R. I., September 29, 1877.

SIR: In obedience to orders of the 20th instant, we have witnessed the examination of the class under torpedo instruction conducted in accordance with the programme prepared by Capt. K. R. Breese, commanding station, and approved by the bureau.

It has been exceedingly gratifying to us to see the skillful and successful manner in which the experiments allotted to the different members of the class (which embraced all the faults and accidents liable to occur in practice) were performed.

When all have done so well, it may seem invidious to particularize; but the board desires to mention the circumstance of the invention of a fuse by Lieutenant Gilmore, which seems to be simple and reliable, and easily prepared from material always to be found on board ship.

We desire to speak in complimentary terms of the three commanders in attendance, who, although by their orders not required to undergo an examination, yet undertook and successfully performed the operation of blowing up a wreck, using the outfit ordinarily supplied to a cruising vessel of war. The board are informed that throughout the course these gentlemen have been constant in attendance and earnest in their efforts to profit by the course of instruction.

We also desire to speak in terms of commendation of the papers submitted by the members of the class upon the subject of torpedo-warfare, offensive and defensive, which show that the subject has received their careful attention.

While the bureau is familiar with the character of the officers and instructors of the station, yet the board deem it but just to add their commendation. Lieutenant McLean exhibited the successful operation of a steam-launch by an electric apparatus, of his invention, placed on the wharf.

We cannot but regret that the station is to lose the services of so valuable an instructor as Lieutenant Converse.

We would recommend that the crew of the Nina be increased to at least twenty-five men, as the present number appears to be too few to attend to the many duties required of them.

Very respectfully,

D. M. FAIRFAX, *Commodore.*
THOS. SCOTT FILLEBROWN,
Captain.
B. B. TAYLOR, *Commander.*
EDW'D E. POTTER, *Commander.*

Commodore W. N. JEFFERS, *U. S. Navy,*
Chief of Bureau of Ordnance,
Navy Department, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., October 1, 1877.

SIR: I have to report that the board of visitors, consisting of Commodore Fairfax, Captain Fillebrown, and Commanders Potter and Taylor, visited the station on Thursday, the 27th ultimo, at 10 a. m., and were received by the officers and a salute of eleven torpedoes.

The class of officers in attendance and those under instruction were then presented to the board.

At 10.30 a. m. the board assembled in a room assigned to them, and the following papers were presented with such verbal explanations as were required:

I. The assignment of officers to duty during the course of instruction.
II. The course of instruction.
III. The programme of instruction.
IV. The course of instruction in torpedoes.
V. The course of instruction in electricity.
VI. The course of instruction in chemistry and explosives.
VII. The course of instruction in fuses and torpedo-warfare.
VIII. Programme of the examination as approved by the bureau.

The board having announced their readiness to witness the examination, and having made the detail of the officers under instruction, in accordance with the programme proceeded to visit the different establishments of the station in order.

The names of the officers assigned by the board to the questions are given, and at the places specified they were found in readiness to explain the general character and uses of the outfit or to remedy their defects before the board.

While some were explained with greater readiness than others, without exception the explanations of the class were satisfactory and conclusive of their knowledge and use of the torpedo-outfits as supplied to the ships of the Navy, and also of the attention paid to the subjects of the lectures during the course of instruction.

Selections among the officers could have been made in certain cases that would have given more apparent credit to the instruction, but, as the assignment was made by the board at hap-hazard, without any reference to the abilities of the class, and the result establishing the fact of the familiarity of the officer with the subject, I have to think the plan adopted was the fairest to represent the general character of the course and proficiency of the individuals of the class.

Lieutenant-Commander Wood was forbidden by the surgeon to take part in the written course for the two or three weeks previous to the examination, and also from appearing before the board; but I am glad to say that his great attention prior to his illness established his capacity, and that an examination would probably only have still further developed it.

The weekly-examination books of the class, while not averaging as good as those of the class of last year, were fairly kept, and contain the gist of much information valuable to the officer of the future.

Comanders Selfridge, Bunce, and Norton comprised the officers in attendance on torpedo-instruction. Distinction was always made between the officer in attendance and the officer under instruction. The latter was required to conform to the course as approved by the bureau, and the former simply to attend the course. These officers did everything that the class were required to do, except submit their books for revision by the instructors. They were constant in attendance, very attentive, and took the same, or a superior part in all practical exercises as the members of the class of instruction. No class have left the station in the past three years superior to these commanders in knowledge of the subjects taught here.

As no place had been assigned them in the order for examination, an old hulk was offered to them and placed on the south end of the island as an obstruction to a channel, to be destroyed by the means found in any torpedo-outfit of a ship or squadron, thus exhibiting to the board their familiarity with the subject. Dynamite was substituted for gunpowder, as in war-time it probably would be found on shipboard for such emergencies. The filling, fusing, and placing of the torpedoes used were personally supervised by these gentlemen, and the hulk was destroyed.

There was exhibited to the board a steam-launch fitted with the steering-gear proposed by Lieutenant McLean in accordance with the bureau's directions to prepare a service steam-launch to be set off and controlled by an electric cable; and, although it was the first experiment and the fittings were of a rude character, sufficient was demonstrated to pronounce upon the feasibility of the plan used.

The Lay boat and Ericsson boat were shown to the board but not run.

Professor Farmer's relay to the Lay boat was shown, and the demonstration of one hundred and twenty-eight different things over one wire was made.

An exhibition of the electric light was given for signaling, lighting ships, and lighting up against attack, &c. The Siemens machine on this occasion failed, and the Farmer was substituted for it. Subsequent examination discovered the fault to be not in the machine but in the driving-belts.

The board were taken to the chemical laboratory, where Professor Hill showed his mode of lecturing, and exhibited the principal objects of interest.

At the electrical laboratory Lieutenant Converse explained his circuit-indicator and its advantages.

The very great interest and attention evinced by every member of the board in the explanations by the officers of class, and the subsequent inspection of the station, together with the pertinent questions asked by them, gave a color and an interest to the close of the term of instruction I have never before experienced. Doubtless the board have expressed their satisfaction to the bureau, and I hope it may not be unbecoming in me to state the gratification of the officers of the station and of the class at the appreciation by the board of their labors during the past course.

The instructors have, as usual, been most faithful in the discharge of their duties, and, although the officers in attendance and under instruction embraced all grades from commander to ensign, the dignity of no one was affected, nor was there complaint made.

Respectfully, your obedient servant,

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief of the Bureau of Ordnance, Navy Department,
Washington, D. C.

I.

UNITED STATES TORPEDO STATION,
Newport, R. I., June 1, 1877.

ASSIGNMENT OF THE OFFICERS OF THE STATION TO DUTY.

Lieut. G. A. Converse, U. S. N., senior assistant inspector of ordnance, and instructor in electricity, fuses, and diving.

Lieut. J. S. Newell, U. S. N., assistant inspector of ordnance and instructor in torpedoes.

Lieut. A. R. Couden, U. S. N., assistant inspector of ordnance and instructor in electricity.

Lieut. T. C. McLean, U. S. N., assistant inspector of ordnance, in charge of drawings, plans, records, &c.

Gunner William Burditt, U. S. N., in charge of machine-shop.

Prof. M. G. Farmer, electrician.

Prof. W. N. Hill, chemistry and explosives.

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in charge of Station.

II.

COURSE OF INSTRUCTION.

[Embraces the months of July, August, and September.]

The attendance of officers for instruction will be from the 9.30 a. m. to the 2.20 p. m. boat.

The day is divided into two periods.

First period from 9.45 a. m. to 11.45 a. m.

Second period from 12.15 p. m. to 2.15 p. m.

The following division of time will be observed, unless due notice is given of change:

	First period, 9.45 a. m. to 11.45 a. m.	Second period, 12.15 p. m. to 2.15 p. m.
Monday	Electricity	Electricity.
Tuesday	Torpedoes	Chemistry or explosives.
Wednesday	Electricity	Electricity.
Thursday	Chemistry or explosives	Torpedoes.
Friday	Torpedoes	Examination papers.

The principal instructor will assign the whole or part of a class to a period.

III.

The officers under instruction will be divided according to rank in two parts, and will be known as the senior half and the junior half.

Any change of programme from the established order will be posted in the officers' room at the machine-shop.

Pocket note-books will be furnished the class for daily notes, and a blank-book for each branch of instruction, in which drawings and examinations will be recorded.

Questions bearing upon the lectures will be given out at their close; and the replies, carefully given and neatly written in the blank-books furnished for the purpose, must be handed in to the commanding officer on Monday.

The books will be examined by the instructors, errors noted, and then returned by the commanding officer with such remarks as may be deemed necessary.

The final examination will be of a practical character before the board of visitors, and the books of the class are to be submitted to the board.

Opportunity will be given to officers to practice in diving and submarine work connected with torpedoes, and, at the close of the term, such officers as show themselves proficient will receive certificates as divers.

Officers who desire to continue their studies will be (if circumstances permit) allowed to remain, and be attached to the station.

The course as above prescribed has been approved by the Chief of the Bureau of Ordnance and the honorable Secretary of the Navy.

K. R. B. REESE,
Captain, U. S. N., Inspector of Ordnance, in charge of Station.

IV.

TORPEDO STATION,
Newport, R. I., September 27, 1877.

SIR: During the course of instruction just completed there have been given in torpedoes fourteen lectures, of two hours each, and twenty-two periods of practical work, each period covering at the least two hours.

Lectures have been given upon the following subjects, and in the order mentioned:

One on the means of exploding torpedoes now employed in the service, and the manner of fitting service-torpedoes.

One on service spar-torpedoes, and the history of torpedo-warfare.

Two on the general division of torpedoes, history of the spar-torpedo, and the outfits of ships.

Two on splicing cables; permanent wires on board ship; improvised torpedoes; ship's fittings; service boat-fittings, including other plans; monitor and tug fittings.

One on improved boat-fittings and fast torpedo-launches.

One on experiments with towing-torpedoes.

Two on the Harvey sea-torpedo.

Two on the French and Danish towing-torpedoes, movable torpedoes, and Ericsson's movable torpedo.

Two on the Lay torpedo, defense of ships against torpedo attacks, and the removal or clearing of a channel when obstructed by torpedoes.

The practical work has been so arranged as to follow the lectures upon the different subjects, illustrating the practical application of the lectures.

One period in detecting faults in electrical apparatus used in connection with service torpedoes, wires, and fuses.

One period in fusing, handling, and exploding exercise-torpedoes (5 pounds), two officers to each torpedo.

Four periods in exploding service 75-pounder torpedoes, each officer filling, fusing, and exploding one from a launch.

One period, each officer improvised a torpedo from jugs, cans, bottles, &c., furnished for the purpose, and exploded the same.

One period, each section of the class grouped and exploded together twelve improvised torpedoes.

One period in fitting, fusing, and exploding four service 100-pounder torpedoes from the Nina under a floating target.

Thirteen periods in the practical use of the Harvey sea-torpedo, each member of the class making two attacks upon the schooner Joseph Henry. The first attack the schooner did not try to evade, but the second attack every effort was made to evade the torpedo. In the latter case, at times, two torpedoes were towed from the Nina, one on each side, the schooner being defended by the same. The schooner, on all occasions, had on board a portion of the class who had charge.

Very respectfully, your obedient servant,

J. S. NEWELL,
Lieut., U. S. N., Assistant Inspector of Ordnance and Instructor.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Station.

V.

UNITED STATES TORPEDO STATION,
Newport, R. I., September 26, 1877.

SIR: The instruction in electricity for the term now ending has consisted of the following lectures delivered before the class:

1. Technical terms, meaning of.
2. Galvanic batteries.
3. Galvanic batteries continued.
4. Galvanic batteries continued.
5. Electric currents, laws of.
6. Electric currents, measurement of.
7. Electric resistance, laws of.
8. Electric resistance, laws of, continued.
9. Electric currents, heating effects of, application to electric fuse-making.
10. Electric resistance, measurement of.
11. Strength of current, electro-motive force and battery resistance, measurement of.
12. Electro-motive force and battery resistance, measurement of.
13. Battery resistance, measurement of.
14. Arrangement of battery cells for any particular work.
15. Magnets and magnetism.
16. Ampère's theory of magnetism and electro-magnetism.
17. Electro-magnetic induction.
18. Induction machines, Wilde's small machine.
19. Farmer's machine, pattern A.
20. Farmer's machine, patterns A and C, Siemens' small machine.
21. Comparison of machines which have a high resistance and have a high electro-motive force, taking Siemens' machine as a pattern, with machines which have a small resistance and a small electro-motive, taking Farmer's machine as a pattern.
22. Wheatstone's, Breguet's, Beardslee's, and Gramme's machines.
23. Electrical apparatus of Lay's boat.
24. Friction as a source of electricity, Smith's machine.
25. The source of electricity most suitable for torpedo purposes in service afloat.

This course of lectures has been supplemented by a course of practical work of four hours per week.

This work has consisted in setting up batteries, measurements of resistance, insulation, electro-motive force, battery resistance, strength of current, using various methods, measurement of machines, calculation of resistance from dimensions and quality of conductors, calculation of number and arrangement of battery cells necessary to do certain work, same for machines, repairing faults in machines purposely out of order, and other work of the same nature.

Very respectfully,

A. R. COUDEN,
Lieutenant and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, Commanding Torpedo Station.

VI.

COURSE OF INSTRUCTION IN CHEMISTRY AND EXPLOSIVES.

Chemistry.

1. Chemical theory; formula and equations.
2. Oxygen; oxides; bases.
3. Atmosphere; ozone; hydrogen; natural waters.
4. Nitrogen; nitric acids and nitrates; action of nitric acid on organic bodies.
5. Acids and salts; compound radicals ammonia.
6. Fluorine and hydrofluoric acid; chlorine.
7. Hydrochloric acid; bromine; iodine.
8. Sulphur; sulphuric acid.
9. Bi-sulphide of carbon; phosphorus; arsenic.
10. Antimony; silicon and silicates.
11. Carbon; carbonic acid; preparation of liquid carbonic acid and its use as a motor.
12. Iron and iron smelting.

Explosives.

1. Explosive reactions; explosive effect.
2. Detonation; general composition of explosive bodies.
3. Explosive mixtures; gunpowder begun.
4. Gunpowder continued, materials for, and process of manufacture.
5. Gunpowder continued, manufacturing processes.
6. Gunpowder continued, tests; results of explosion; force.
7. Gunpowder completed; effect of condition; regular grain.
8. Chlorate mixtures.
9. Nitro-glycerine; manufacture; properties; use.
10. Dynamite; manufacture; properties; use.
11. Gun-cotton; manufacture; properties; use.
12. Picrates; picric powder; fulminates; fulminating mercury.

Lectures illustrated by experiments and diagrams, and drawings projected on screen by calcium light.

Class present at time of making nitro-glycerine and dynamite.

Experiments made with different explosives.

VII.

UNITED STATES TORPEDO STATION,
Newport, R. I., September 26, 1877.

SIR: I respectfully submit the following report of practical work in fuse-making during the term of instruction just ended. Four hours per week have been occupied in this work.

Each officer has been required to make the following fuses and igniters:

Ten D. E. wooden case igniters; ten D. E. copper case igniters; three improvised fuses, Barber's; three improvised fuses, Moore's: three improvised fuses, Pillsbury's; three improvised fuses, from wire to be supplied; one original.

In addition to this, lectures have been delivered before the class as follows:

1. The various methods of determining the position of a ship with reference to any individual torpedo or group of torpedoes in a defensive system, and the electrical apparatus used for testing and firing such torpedoes; explaining the methods of determining the position of a ship by cross-bearings, use of plane-table, electric position-indicator, and camera obscura, and the use of testing and firing apparatus for systems of this kind.

2. Continuation of subject of previous lecture, explaining use of circuit-closer, circuit-breaker, and circuit shunts; exhibited and explained the English shutter apparatus and the circuit-indicator.

Very respectfully, your obedient servant,

G. A. CONVERSE,
Lieutenant and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, Commanding Station.

VIII.

The examination of the class will be by practical work in the presence of the board of visitors, and as soon as they announce their readiness the class will be assigned by twos or otherwise (at the discretion of the board) to take up, exhibit, and describe the following:

I.

1. Fire exercise-torpedoes from launches.
Fire 75-pounder torpedoes from launches.
2. Test permanent wires on board ship for continuity.
3. Explain Ericsson torpedo to the board.

Assigned to Lieutenant-Commander Woodward and Lieutenant Selfridge.

II.

1. Fire 100-pounder torpedo from Nina.
Blowing up raft by 100-pounder torpedo from Nina.
2. Test reel of insulated and spar-leading wires for insulation.
3. Explain Lay No. 1 to board.

Assigned to Lieutenant Berry and Ensign Fiske.

III.

1. Improvised torpedo.
2. Detection of faults in C machine. (Bell-hammer bent; wire of R coil broken; R coil short-circuited.)

3. Explain the service cast-iron torpedo.

Assigned to Lieutenant-Commander Sterling and Lieutenant Franklin.

IV.

1. Fire group of torpedoes with C machine.
2. Use of articles found in supply-box.
3. Detection of faults in wires.

(Wire broken inside of insulation; short circuited ends of wire in contact at machine or in contact within the case.)

Assigned to Lieut. Commander Elmer and Master Kilburn.

V.

1. Fit, launch, and tow Harvey torpedo, and make attach against Joseph Henry under way.
2. Set up a Kerite firing-battery.
3. Explain Lay No. 2 to board.

Assigned to Lieutenant Forsyth and Master Ellery.

VI.

1. Explain Harvey torpedo.
2. Given 100 igniters arranged in 5 groups of 20 each—200 feet leading wire. No. of station cells. E. M. F. = R. = group battery for the best effects for firing fuses.
3. Explain manufacture of igniter and fuse, and the object of their use to the board.

Assigned to Lieutenant Hunker and Ensign Winder.

VII.

1. Explain torpedo charged with dynamite from boat.
2. Detection of fault in fuse (broken bridge or short circuit).
3. Explain the Harvey torpedo.

Assigned to Lieutenant Berry and Ensign Fiske.

VIII.

1. Explode torpedo charged with gun-cotton from boat.
2. Detection of fault in A machine.

(Commutator short circuited or dirty—springs of commutator not in contact.)

3. Explain object of insulating wires; method of making splices and insulating them.

Assigned to Lieutenant Gilmore and Ensign Danner.

IX.

1. Explode charge of dynamite.
2. Describe torpedo outfit to the board.
3. Given battery and 3 lengths of insulated cable, 2 call-bells and 2 press-knobs. Connect in circuit for signaling so that signal shall be repeated at signal-station.

X.

1. Explosion of charge of frozen dynamite. (This includes making firing charge.)
2. Detection of fault in firing-key (dirty contact points, short circuit

spring bent, needle shows no deflection due to rusty pivot, swelling of wood, or broken coil, or short circuited).

3. Explain in general terms the process of manufacture of nitro-glycerine and conversion into dynamite.

COUDEN'S SHUNT METHOD.

During the past year careful tests and comparisons have been made at this station of the relative merits of various methods of determining the internal resistances of galvanic batteries. Among all of these, none seemed to give better results than what is called the "shunt method."

This method, as usually practiced at this station, is as follows: Introduce into the circuit of a galvanic battery a convenient rheostat and a suitable fine-wire galvanometer. Open and adjust the rheostat until a convenient deflection is obtained (42° 21′ is liable to least error), note carefully the deflection. Next reduce the total external resistance of the circuit one-half. (This presupposes that the rheostat, as opened, offers more resistance than the galvanometer.) The needle will now be deflected more than it was at the first observation. If now another adjustable rheostat be used as a shunt across the terminals of the battery, this shunt can be so adjusted that the reading of the galvanometer shall return to the same position as in the first observation. When this is the case, the resistance of the shunt is equal to the internal resistance of the battery. This method answers well enough for constant batteries, but for those that polarize rapidly, as does the Leclanché, repeated and careful trials are often needed in order to obtain satisfactory results, and it is sometimes impracticable to secure the initial and instantaneous value of the resistance sought.

Lieut. A. R. Couden, U. S. N., instructor at this station, conceived the idea that if the two changes, viz, shortening the resistance and applying the shunt, were made simultaneously, there should be at the first instant no movement of the needle, if the proper shunt were first chosen. He availed himself of the two keys used in manipulating the Wheatstone's bridge to carry out his idea. The results were quite satisfactory, but the two keys being independent of each other, and far apart, required two fingers to press them, and sometimes failed to operate with complete simultaniety. To remedy this, I had constructed for him a key with a single finger-piece, but with two independent contact closers, which admitted of such adjustment as to secure the required simultaneous closing of the two circuits when the key was depressed.

The apparatus as thus constructed operates with entire satisfaction. Measurements have been made with it of 40 bichromate cells, in groups of 10, 20, and 40 in series, and the sum of two 10's agrees within one per cent. of the result of measurements of 20 in series, and so do the measurments of two 20's agree with that of one 40 quite as nearly. Likewise the 40 cells grouped in 5 rows of 8 in series gives within less than two per cent. the same value for the average resistance per cell. This method is remarkably well adapted for making tests of the instantaneous resistances of inconstant cells, not only those in which the internal resistance varies, but those in which the electro-motive force falls off quickly upon a prolonged closure of the circuit.

Another advantage of the method is, that galvanometers of various construction can be readily used; those in which the resistance varies from 10 ohms to 2,000, and satisfactory results are attainable.

Its practical working is likely to be much more satisfactory than Maure's method, inasmuch as one is not likely to find at hand, ordinarily, a galvanometer adapted to making measures with Maure's method to such a nice degree of accuracy.

MOSES G. FARMER,
Electrician.

UNITED STATES NAVAL TORPEDO STATION,
NEWPORT, R. I., *December* 16, 1876.

UNITED STATES TORPEDO STATION,
Newport, R. I., January 23, 1877.

SIR: I have to inclose herewith a letter of Lieut. G. A. Converse, U. S. N. (with an indorsement of Professor Farmer), describing different ways of splicing the leading wires and torpedo cables, which I have to recommend for adoption in the service in place of the present method. Samples forwarded by express. Also modifications and improvements in electric primers, a primer connection, and a form of union designed to be used at guns when fired by electricity; all of which is approved and samples sent by express for the approval of the bureau.

Respectfully, your obedient servant,

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in Charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief of the Bureau of Ordnance, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., January 22, 1877.

SIR: I respectfully submit for your consideration the accompanying—

"Proposed substitute for the present method of splicing the torpedo cables and leading wires now issued to ships.

"Modifications and improvements in electric primers.

"A primer-connection.

"A form of union designed to be used at guns when firing by electricity."

Very respectfully, your obedient servant,

G. A. CONVERSE,
Lieutenant, U. S. N., and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Torpedo Station.

Referred to Professor Farmer for an indorsement on the electrical principles involved.

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in Charge.

PROPOSED SUBSTITUTES FOR THE PRESENT METHOD OF SPLICING THE TORPEDO-CABLES AND LEADING-WIRES NOW ISSUED TO SHIPS.

In all insulated wire now issued to ships for permanent wires, for spar leading-wires, and torpedo-cable, the conductor consists of seven strands of small copper wire, and is, therefore, very flexible. Should it become necessary to join two pieces of cable together it can be done by knotting the wire by, 1st, a sheet-bend; 2d, a reef-knot; 3d, a carrick-bend.

Either of the methods can be used, but it is believed that the sheet-bend can be most easily and readily made, as the "becket" can be formed by bending the end of one of the wires back on itself, and, this being done, there remains but one wire to manipulate and haul taut.

In all cases, after the bend or knot has been made, haul the wires as taut as possible before trimming off the ends.

Advantages over present form of splice:

1st. The "splicing-nippers and splicers" now furnished in the supply box can be abolished.

2d. No special instruction is necessary to enable a sailor to make a perfect splice, and it is believed that the operation can be more quickly performed than by the present arrangement.

3d. It is the strongest way of joining two pieces of wire.

4th. The electrical properties are all that can be desired.

THE ELECTRIC PRIMER.

The modifications and improvements are—

1st. In the operation of putting in the bridge, greater uniformity in the length, and consequently in the electrical resistance, being obtained.

2d. A method of "rounding up" the quills, so that the primers will enter the vent of guns freely.

3d. A method of "choking in" the quills and securing them firmly to the wires.

4th. In the general "get up" of the whole primer.

THE PRIMER-CONNECTION FOR CONNECTING THE PRIMER TO THE LEADING-WIRES.

A quick and easy method of attaching and detaching the primer from the leading-wires and so arranged that the operation can be performed while the gun is being loaded.

To attach a primer.—See that the lower end of the connection is turned back as far as the slot will permit; insert the ends of the wires of the primers, one wire in each hole in the base of the connection, and then turn the lower part around as far as the slot will allow. The primer is firmly held and the electrical contact is good.

After the primer has been inserted in the vent nearly the whole length of the wires, bend the latter at a right angle, which brings the connection clear of the blast of the vent.

To detach the primer.—Turn the lower end of the connection back as far as the slot will permit, and give the primer a slight jerk; it will be detached quite easily.

THE UNION.

As an element of safety while loading, and for the purpose of allowing the primer to be connected to the leading-wires and inserted in the gun before pointing, a break is made in the leading-wire just in rear of the gun, which is to be closed the instant the gun is "laid."

As the bridging over of this break works the indicator on the spar-deck, and announces to the officer stationed there that the gun is ready, it is desirable that this operation should be performed by the person pointing the guns.

To accomplish these results, a bight of the leading-wire hangs down in rear of the gun, sufficiently long to permit the captain of the gun to hold the end in his hands while pointing. This wire is severed and the ends are attached to the union. The captain of the gun holds an end in each hand, and the instant the gun is sighted joins the union.

In devising a suitable union for this purpose, the following points have been considered:

1st. As the break is introduced for safety, it should be so arranged that it is not liable to be closed by accident.

2d. It should be of such a nature that its condition, *i. e.*, closed or broken, can be determined at a glance by all stationed at the gun while loading, or until the captain of the gun has taken it in his hand.

3d. When closed it is a signal that the gun is ready for firing, and as the firing-current is to pass over the same wire, the break should of its own accord remain closed until intentionally broken. This requirement precludes the use of a press-button, or similar contrivance, for, having a tendency to automatically break the circuit, it would require the *simultaneous action* of two persons to fire a gun, or of *five* to fire a broadside in the case of the Trenton. Therefore no arrangement, designed either to break or close the circuit automatically, can be used.

I cheerfully indorse the above as fulfilling all the necessary electrical conditions. I would call attention to the "primer-connection," which insures the formation of a clean, firm, and permanent electrical contact. The important features of the "safety-union" are, 1st, its condition can be readily seen at any time by all persons handling the gun; 2d, its non-automatic character reduces to a minimum the number of men required.

Very respectfully,

MOSES G. FARMER,
Electrician.

UNITED STATES TORPEDO STATION,
Newport, R. I., March 21, 1877.

SIR: I had hoped to be able to forward with the corrected invoice of the Trenton's electric apparatus a detailed description, with drawings, but owing to the want of a practiced draughtsman, and the fact that Mr. Converse and Mr. Couden are very much occupied, I have been unable to do so.

The following extracts of a report made to me I give in explanation to the bureau's indorsements on the original invoice sent to the bureau, and will forward, as soon as possible, full and detailed drawings and descriptions:

> The apparatus furnished was for two distinct purposes, first, firing guns and torpedoes; second, calls and automatic fire-alarm.
>
> That intended for guns and torpedoes was designed to place the firing under the control of a single officer stationed at some central point, who shall be able to fire any gun when it is ready, or either or both broadsides, or as much of a broadside as may be ready.
>
> The fact that a gun is ready to be fired should be automatically signaled to the officer firing the guns. This signal should only be shown while the gun is actually ready; that is, if the captain of the gun, after having once been ready, desires to change his aim, the fact that the gun is no longer ready should be known to the firing officer. The gun-captain should be able to prevent the firing of the gun by a simple movement, without self-exposure, whenever firing would result in injury to the gun, carriage, or gun's crew, or throwing away shot. The captain of the gun should know whether his primer and connections are good, independently of the signal to the officer firing.

The Trenton's apparatus fulfills these conditions, and consists of the "firing-apparatus," located on the bridge; a "tell-tale" in rear of each gun; a "wire union" at each gun and torpedo; a "primer-connection" for each gun; a "signal-battery"; a "firing-battery"; and the necessary "wire" for connecting.

The firing-apparatus contains a firing-key for each gun and torpedo, a firing-key for each broadside, a signal number or letter, corresponding to each gun and torpedo, and an electro-magnet for each gun and torpedo.

A tell-tale is a galvanometer, the movement of whose magnet displays two red quadrants in a white field. Its object is to inform the captain of the gun that his connections and primer are good.

A wire union is a simple arrangement for electrically connecting two wires. It is held in the hand of the gun-captain. When his gun is ready, he makes the connection; when not ready, he breaks the connection. Either can be done in a moment.

A primer-connection is an arrangement for connecting the primer into the electrical circuit.

The signal-battery consists of twelve large modified Le Clanché cells, and furnishes the signal-current which tells the firing-officer that guns and torpedoes are ready, and the gun-captains that their connections and primers are good. This battery also furnishes current for certain bells.

The firing-battery consists of twenty medium modified Le Clanché cells, and furnishes the firing-current for guns and torpedoes.

The wire for connecting consists of a wire from each battery to the firing-apparatus on the bridge, a wire from the firing-apparatus to each gun and torpedo, in each case connecting in tell-tale, wire union, and primer-connection, and a common return wire from all the guns to both batteries.

This common return wire is also used in connection with bells.

The apparatus for calls and fire-alarm consists of five small vibrators four large vibrators, seven push-buttons, three bell-pulls, one battery, five thermostats, one small annunciator and wire for connecting.

The five small vibrators were for orderlies, pantry-yeoman, and master-at-arms. The push-buttons and bell-pulls were for use with the bells. The four large vibrators were placed near the fore and main masts, on the gun and berth decks, for calling crew to quarters at night, and for signaling to powder-division while at quarters. They may be rung from bridge or from captain's cabin. The current for ringing them is supplied by the signal battery of twelve cells, previously described.

The five thermostats, set at 140° Fahrenheit, were placed one in each of four coal bunkers and one in general store-room.

The annunciator of four numbers is used in connection with thermostats to give alarm, and indicate locality of fire.

The battery consists of four medium Le Clanché cells (modified), and furnishes current for small bells and for the annunciator.

The wire for connecting consists of the necessary wire for connecting the battery press-buttons, bell-pulls, and bells, and for connecting thermostats, annunciator, and battery.

The wire about the ship was led through holes bored in the beams and underneath "fore and aft pieces," and covered in with ash battens or scotchmen. Where wires passed from deck to deck a brass pipe was used to protect the wires from water.

All wire-splices were soldered and insulated with rubber tubing.

The apparatus was tested after it was in place, and everything worked perfectly.

I regret to say that the cost of these articles has much exceeded the estimates, but as it was all new ground and the workmanship of a delicate and special kind, I am, in consideration of what the apparatus performs, and the experience to be gained from it, satisfied that the service will get due benefit from it.

Respectfully, your obedient servant,

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance in Charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief Bureau of Ordnance, Washington, D. C.

PROPOSED SYSTEM OF WIRES FOR TRENTON.

For signaling:

Commander-in-chief: Call-bell on bulkhead for orderly and steward. Buttons as convenient in cabin and state-room. Commanding officer: Same. Executive officer: Call for master-at-arms.

Eight-inch gongs near foremast and mainmast, on gun and berth deck, for calls to general quarters and fire-quarters at night, for use of commanding officer or officer of deck, as desired.

Thermostats in general store-room, forward coal-bunker, starboard and port bunkers, on each deck, set to 120°, to connect with annunciator on cabin bulkhead, near captain's orderly.

For firing torpedoes:

Wires leading from electric firing apparatus to bulwarks, abreast of heels of torpedo-spars.

For firing battery:

Wires leading from electric firing-apparatus to rear of each gun on gun-deck.

The officer assigned to take charge of putting up the wires, &c., will take with him from here all the necessary material.

The position of keyboard for firing the battery and torpedoes is proposed to be placed on the bridge.

The electric primers making up for the Trenton are thought to be great improvements over the old ones, are of uniform resistance, and near the igniter for fuse for torpedoes: designed by Lieutenant Converse.

Position of battery (galvanic) to be decided on.

The above has been communicated to Commander Ramsay.

TORPEDO STATION,
Newport, R. I., July 20, 1877.

SIR: I respectfully submit the following account of a series of experiments recently made with the electric cannon-primers and primer-connections, manufactured at this station for the United States ship Trenton.

At the time the primers were made there were no facilities for testing them as fully as was desirable, owing to the want of a gun of large caliber. Experiments made at that time with the 12-pound howitzers proved the primers to be all that could be wished for guns of that class. Other experiments, made with a brass tube 0.24 inch in diameter, 0.04 inch larger than the standard for vents of guns, and 36 inches long, were sufficiently successful to justify the conclusions that the primers would fully meet all the requirements of the Trenton's 8-inch rifles. It seemed advisable, however, to make additional experiments with the largest guns in the service whenever opportunity should occur. Advantage has been taken of the presence of the Alarm, with a XV-inch gun, for this purpose; Lieutenant Paine having kindly given his consent, and greatly assisted in making the tests.

The object of the experiments was to determine—

First. (*a*) Power of the primers; (*b*) Liability of wires to obstruct the vent; (*c*) Liability of fragments of the quills to remain in the vent.

Second. Liability of moisture or salt-water to make a short circuit in primer-connection.

Third. Effect of defective insulation of leading-wires, in addition to wet connections.

Fourth. Effect of salt-water on primers.

Fifth. Effect of defective insulation of leading-wires, and salt-water on battery.

FIRST.

1. XV-inch gun. Charge, 35 pounds cannon-powder. Cartridge set home without being rammed.

(*a*) Service cartridge-bag, not pricked. Distance from top of vent to top of cartridge 21½ inches. Fired on closing circuit.

(*b*) Primer thrown entirely clear of vent.

(*c*) Quill split longitudinally, but remained fast to wires.

2. XV-inch gun. Charge, 35 pounds cannon-powder. Cartridge set home without being rammed.

(*a*) Service cartridge-bag, not pricked. Distance from top of vent to top of cartridge 22 inches. Fired on closing circuit.

(*b*) Primer thrown entirely clear of vent.

(*c*) Quill split longitudinally, but remained fast to wires.

3. XV-inch gun. Charge, 35 pounds cannon-powder. Cartridge set home without being rammed.

(*a*) Service cartridge-bag, not pricked. Distance from top of vent to top of cartridge 22¼ inches. Fired on closing circuit.

(*b*) Primer thrown entirely clear of vent.

(*c*) Quill split longitudinally, but remained fast to wires.

4. XV-inch gun. Charge, 35 pounds cannon-powder. Cartridge set home without being rammed.

(*a*) Two service cartridge-bags, one inside the other, not pricked. Distance from top of vent to top of cartridge 22¼ inches. Fired on closing circuit.

(*b*) Primer thrown clear of vent.

(*c*) Quill split longitudinally, but remained fast to wires.

SECOND.

A single cell of firing-battery, with two leading-wires, each about twenty feet long, was used.

The primer having been inserted in the "connection," the latter was entirely submerged in sea-water.

Primer fired on closing circuit.

This test was repeated three times with the same results.

THIRD.

The connections were the same as in the second experiment. Each leading wire had a splice about one inch long made in it, and both splices, uninsulated, were submerged in a cup of sea-water, the "primer-connection" being also submerged as before.

Primer fired on closing the circuit.

Repeated this experiment several times, with the same results.

FOURTH.

Primers were immersed in sea-water for upward of five minutes, without showing the slightest signs of injury or becoming damp.

All exploded with the usual force.

FIFTH.

Connections were made as in the second experiment.

Primer-connection, bare splices, and battery-cup entirely submerged in sea-water.

Primers fired on closing the circuit.

Experiment repeated several times, with the same results.

The primers used in these experiments were from the lot manufactured for the Trenton.

The battery used was a large-sized Kerite-covered zinc cup, with the Leclanché electrode covered with a bunting bag, of the same pattern as those furnished the Swatara and Trenton.*

The fragments of the primers used in the XV-inch gun are transmitted herewith.

Although these experiments undoubtedly prove that the primer is sufficiently powerful for general use in the service, I would recommend that other experiments be made, using hexagonal or other large-grained powder, whenever a favorable opportunity occurs.

I am, sir, very respectfully, your obedient servant,

GEORGE A. CONVERSE,
Lieutenant, U. S. N., and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. A.,
Inspector of Ordnance, in charge of Torpedo Station.

UNITED STATES TORPEDO STATION,
Newport, R. I., May 7, 1877.

SIR: I have to inclose a report of Professor Hill on some experiments with dynamite. These experiments, although in contemplation as a part of the examination into nitro-glycerine and its compounds, were advanced by my direction, with a view of settling, if possible, a difference of opinion between Professor Hill and Lieut. R. B. Bradford relative to the action of dynamite under certain conditions.

Lieutenant Bradford quoted a French authority for the necessity of an absolutely tight vessel for dynamite, and General Abbot, United States Engineers, for the certainty of exploding frozen dynamite. Professor Hill took issue with him on these subjects.

Leaky vessels for dynamite, unfrozen, were found not to affect the explosion when left in the water for a short time. Experiment is to be made with dynamite in a basket, and from that degree to such accidental leaks as may be found in castings or made-up torpedo cases, and exposed for different lengths of time to establish whether, "after a certain time, the nitro-glycerine will be washed out of a leaky case."

The uncertainty of exploding frozen dynamite even with excessive charges of fulminate of mercury is well established.

Experiments will be made for a new fuse to explode frozen dynamite.

Respectfully, your obedient servant,

K. R. BREESE,
Captain, U. S. N., Inspector of Ordnance, in charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief Bureau of Ordnance, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., April 30, 1877.

SIR: I submit the following *résumé* of the experiments of the last winter in frozen dynamite.

Our experimenting with frozen dynamite extends back several years, and many experiments have been made. I must first briefly refer to these experiments.

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* This battery was designed by Lieutenant Converse, and is known at the station as the Converse battery.—K. R. BREESE, *Captain U. S. N., Insp. Ord., in charge.*

As is well known, liquid nitro-glycerine is readily exploded by 5-10 grains of fulminating mercury, but when frozen I have never been able to fire it. Dynamite, presenting a different mechanical condition, behaves differently.

When dynamite freezes to a loose, fine powder it may be exploded with tolerable certainty by the ordinary detonating fuse (15-20 grains of fulminate). In a large number of experiments, with small amounts, I have found but very few cases when explosion did not occur. But in proportion as it is solidly frozen, that is, compacted together, the explosion is less sure, until, if the mass is very solid, firing becomes very uncertain.

Differences may be found in different dynamites. Some will fire more readily when frozen than others. This is perhaps due to differences in the sensitiveness of nitro-glycerine. (I have demonstrated that variations in sensitiveness of dynamites are noticeable by experiments made during the last year). But it is more probably principally caused by variations in mechanical condition. Thus one dynamite is drier than another, either from its containing a little less nitro-glycerine or because the absorbent is a little better. As dynamite is merely a mechanical mixture, slight variations of such kinds will naturally occur.

Evidently the drier dynamite will be less likely to become compacted and more likely to freeze loosely (pulverulent) than the moister, which will pack together while thawed and soft.

Also, it is plain that in large masses this agent will behave differently than in small. In a large case the weight of the mass will cause it to settle down, since the dynamite, when used (that is thawed), is soft and yielding and capable of being packed. (Thus, by driving in paper cartridges, it may be made to have a specific gravity of 1.5, while if simply filled in it will be no more than 0.9.) Then, if the dynamite becomes frozen, either it may freeze so solidly as not to be fired at all, or part of the charge may get into this condition while the remainder may be capable of explosion. (I have observed instances where part of a frozen charge would explode and part be scattered without firing, although it must be admitted that these were small amounts, in paper cartridges, fired in open air. Perhaps in a large mass this might not occur; but it is necessary to guard against such a chance.)

Previous to this winter, nearly all the experiments I have made with frozen dynamite were upon a small scale, say in quantities of one-half pound to two pounds, in paper or tin cases, and fired in the open air. The ordinary detonating fuses were used in most cases. Some curious results were noticed; but in the main the conclusions drawn in regard to the explosion of frozen dynamite are those which have been already given.

It seemed to be very desirable to try further experiments, and especially on a larger scale, and under the circumstances of practice. In larger quantities the probability of solid packing and freezing occurring is much increased, while, on the other hand, it is possible that on a large and more resisting mass the effect of the fuse may be different than in a small cartridge, which it can tear to pieces, scattering its contents.

During the past winter, all the experiments possible with the limited means at hand have been made, with the the results given below.

In these experiments the dynamite was always handled while thawed, and allowed to freeze in the case, usually in the water.

Charges of 40, 50, and 100 pounds were used in iron torpedo cases. These were heavy, difficult to handle, and had to be planted on the west side of the island, requiring more men to do the work than could always be had. So, to economize labor, and to continue the trials, tin cans, holding 5 to 7 pounds, were taken for preliminary experiments, to serve as guides for the larger ones. These were usually placed on the east side of the island.

The fuses employed in all these experiments were the ordinary detonating exploders, containing 15.20 grains of fulminating mercury. In some of the first trials it was found that exploders would not always resist (they were not intended to) long exposure at considerable depths, if the case leaked and filled with water, becoming dampened and useless. (It should be remarked that in many of these experiments the cases were intentionally not water-tight.) To avoid this difficulty, the exploders were protected by a coating of gutta-percha, being thus easily rendered impervious.

SMALL CASES.

No. 1. Six and a half pounds. Tin case. Ordinary detonating exploder. Case closed with cork, carrying exploder-wires, and not fitting tight. Placed in 18 feet of water February 8. February 16 tried to fire, without success. On weighing, found defect in connection.

No. 2. Same as No. 1, except that case contained 7 pounds. Placed and attempted firing at same time as No. 1. Failed to explode, and, on weighing, found exploder dampened and useless. In both these the dynamite found frozen hard.

No. 3. Seven pounds. Tin case. Fused as in Nos. 1 and 2. Twenty feet of water, February 19. Temperature of water 1° C. February 20 fired exploder without exploding dynamite. Found that the exploder had completely broken up in charge. Temperature of water 2° C.

No. 4. Same as No. 3, except that exploder protected by covering of gutta-percha. Same result as No. 3.

No. 5. Seven pounds. Tin case. Two exploders (protected) branched. Placed in 18 feet water February 26. March 1 both exploders fired in charge, bursting case and scattering dynamite, but without exploding the latter. Dynamite frozen hard.

No. 6. Same as No. 5, with same results.

No. 7. Five pounds. Tin case. Fused with one exploder, containing 40 grains of fulminating mercury. Placed March 10, and on March 12 tried to fire, but exploder was defective.

No. 8. Same as No. 7.

No. 9. Same charge as No. 7. Fused with one exploder, containing 50 grains of fulminate. Placed March 10. March 12 exploder fired, bursting open case, but without firing dynamite. Dynamite hard frozen.

No. 10. Same as No. 9.

No. 11. Repetition of No. 7. Placed March 19, and on the 20th fired, exploder bursting case open without firing dynamite.

No. 12. Same as No. 11.

LARGE CASES.

No. 1. Forty pounds dynamite. Old sheet-iron spar-torpedo, not water-tight. Two exploders (usual detonating) branched February 16, placed in 33 feet water. February 20 exploded torpedo with usual effect.

No. 2. Forty-five pounds dynamite. Otherwise same as in No. 1.

Placed in 21 feet water February 16. February 27 failed to fire. On weighing found that both exploders had fired completely. Dynamite hard frozen.

No. 3. Same as No. 1, with 49 pounds dynamite and exploders protected. Placed in water February 20. March 8 failed to explode charge, although exploders were fired.

No. 4. Same as No. 3, and with same result.

No. 5. Cast-iron spar-torpedo case, with 100 pounds dynamite. Two protected exploders branched. Allowed to freeze in open air after fusing and before planting. Placed in water March 12. March 24 failed to explode charge although exploders fired all right.

No. 6. Same as No. 5, but with one protected exploder, containing 50 grains of fulminate. Placed in water March 24. April 7 exploded with great effect.

No. 7. Cast-iron spar-torpedo case without spindle; 121 pounds dynamite. In center of charge, a tin can put, containing 12 ounces loose (spread out to freeze) frozen dynamite and one ordinary exploder. Placed in water March 29. April 7 exploded with great effect.

NOTE.—During the time which elapsed between the filling and firing of Nos. 6 and 7, the weather had become much milder, and it is therefore possible that, in these instances, the dynamite did not freeze as completely as in the others. It was therefore desirable to repeat them.

No. 8. Same as No. 6. After filling torpedo, placed in ice for 36 hours until frozen. Planted and tried at once. No explosion followed, and on examination it was found that the exploder had gone off all right, but without affecting dynamite.

No. 9. Same as No. 7, and treated in same manner as No. 8. Exploded with great effect.

We therefore conclude that an exploder containing fulminating mercury only will not fire frozen dynamite with any certainty. In these trials it did so twice, but in one instance (No. 6 of the large cases) it is doubtful if the charge was well frozen, and in regard to the other, it must be remarked that an exactly similar torpedo, which remained in the water a longer time (11 days instead of 4), was not fired; so it is possible that the same explanation may apply in this also.

In previous experiments on the small scale I have succeeded in exploding frozen dynamite much more often than in these trials.

To insure the explosion of frozen dynamite in torpedoes, some better means must be found than the ordinary exploders.

The most obvious way would be to arrange an exploding charge of loose dynamite (as in Nos. 7 and 9 of the large cases) to be fired by an ordinary exploder. I have rarely found that loose pulverulent dynamite would fail to be exploded in this way, although I have had a very few such occurrences. Probably there would be no difficulty in making this sure, however.

I also have had one instance (in winter of 1875-'76) when an initial charge of loose exploded without putting off the main body, but it was only ½ ounce in a cartridge of 16 ounces, while in these later experiments 12 ounces of loose were used in a charge of 100 pounds or more.

There would probably be little practical difficulty in arranging such an initial charge. The dynamite is easily got in the right state, and it only requires to be placed in a case strong enough to protect it from the mass of the charge. To insure that this fuse-dynamite should remain loose and pulverulent, it might be made a little less rich in nitro glycerine than the rest, so that it would be drier and without tendency to pack.

However, further experiment must be made to *prove* that frozen dynamite can be certainly fired in this way, and to indicate the best method of arranging torpedoes and exploders with this object in view.

In addition, it would be important to try other kinds of exploders, to see if some better means of firing could be obtained.

If dynamite is to be used in torpedoes, this matter must be worked out and a certain means of exploding it at all times found.

Besides the experiments which have been mentioned above, some trials of a method of measuring the force exerted by frozen and thawed dynamite comparatively were made. The preliminary experiments were successful, and the method seemed to promise well. Preparations were made to carry them on, but they have not been performed from lack of the pressure-gauges required.

During the present season I have to complete some series of experiments with various dynamites and on modes of firing this explosive in its usual condition.

The experiments with the frozen dynamite should be resumed next fall and winter. In order that this may be done, the dynamite must be prepared in advance. I would respectfully recommend that it should be made during the coming summer. As no work of this kind has been done here for nearly eighteen months, we have no materials on hand.

Very respectfully,

WALTER N. HILL,
Chemist.

Capt. K. R. REESE, U. S. N.,
Commanding United States Torpedo Station, Newport, R. I.

INSTRUCTIONS.

Keeping and use of dynamite—supplies, storage, &c.

1. Dynamite is supplied in wooden boxes holding 25 and 50 pounds. The boxes are carefully made, so as to be strong and tight. The covers are fastened on with brass screws, the joint being made tight by means of a thin rubber gasket. The boxes are painted a brownish-red.

2. Dynamite should be stored in a cool dry place.

3. When stored, the covers of the boxes containing dynamite should be slightly loosened by turning back the screws a few turns and springing up the covers, if necessary. The projection on the inside of the cover will sufficiently close the box without preventing some communication with the external air.

4. The boxes will be marked on one side in black, the marks indicating the contents, gross and net weights and numbers, and date. Each box has two numbers; the first is the lot number and the second the box number. The following is an example of the mode of marking:

DYNAMITE.

Weight, 62—50.

Lot 33, No. 44.

November 30, 1875.

The inside of the cover of each box will also be similarly marked. In making up records or statements, use *both numbers*.

5. With each lot of dynamite are supplied two boxes, containing tools and other articles necessary for use with it, and one lead-lined-box. The box marked Dynamite, Supply No. 1, contains silica for use in case absorbent material is needed and materials for testing.

The box marked Dynamite, Supply No. 2, contains 1 copper scoop, 1 copper funnel, 2 wooden spatulas, and 2 wooden rods for handling the dynamite; 1 screw-driver, 1 paper small copper tacks, 1 roll paraffined paper, and 1 small copper hammer for repairing the lining of the boxes, if required. The box marked Dynamite No. 3 is the lead-lined box used for remixing the dynamite.

Possible changes; frequent examination.

6. Exudation (separation of liquid nitro-glycerine) must be carefully guarded against. A tendency toward exudation is indicated by a change in appearance, the dynamite becoming moist and sticky instead of dry and pulverulent, and by a difference in dryness of the upper and lower portions of the mass.

Finally, if exudation occurs, oily drops of liquid nitro-glycerine will be found in the bottom of the box containing the dynamite. To prevent this taking place, the dynamite should be frequently examined, at least once a month, and in very warm climates once in two weeks. In examining to detect tendency toward exudation it should be noted, if the dynamite seems to have become much softer or stickier than at the last examination, if on stirring carefully the contents of the box with the wooden spatulas provided for the purpose the lower part seems to be moister than the upper, and, finally, if any liquid has actually separated. If any distinct difference in dryness is noticed between the upper and lower portions, the dynamite should be remixed with the wooden spatulas in the box containing it, or the box may be emptied into the lead-lined box, in which the operation may be more easily and thoroughly performed. If the dynamite merely seems to be a little softer or moister, nothing need be done with it; but if it becomes plainly wet or pasty, or if drops of liquid are found to have exuded, then it may be readily restored to its original condition by stirring it thoroughly with a small quantity of fresh absorbent (silica), which is supplied for this purpose. This must be done in the lead-lined box with the wooden spatulas. Pains must be taken to obtain a complete mixture of the fresh material with the old.

It is improbable that any trouble should be experienced from exudation; but if it should occur, it can be entirely overcome in the above manner without danger.

It should be borne in mind that dynamite is a mechanical mixture of liquid nitro-glycerine with a solid absorbent. Its freedom from a tendency to exudation depends upon the absorbing power of the absorbent used. Nitro-glycerine at comparatively high temperatures is much more fluid than at lower ones. Therefore, in order that separation should not take place at any time, there must be a sufficient excess of absorbent power. The dynamite supplied has such excess, but it will, of course, be slightly softer in a warm climate than in a cooler one. As long as it is dry enough to be handled, it is in a satisfactory state.

7. In examining, remixing, or otherwise handling dynamite, pains must be taken not to scatter it about. Boxes should be open and all work performed upon a piece of tarpaulin or canvas, which can be rolled

up and shaken afterward. Any dynamite scattered must be carefully swept up. All tools, boxes, &c., used in handling dynamite must be carefully wiped before being put away. Each time the lead-lined box is used, it must be nicely cleaned by wiping it out with cotton-waste or clean rags. All waste material (rags used in cleaning, &c.) should be thrown away.

8. Decomposition of the nitro-glycerine is not likely to occur. If it should take place, it may be recognized by a strong nitrous odor, due to the evolution of oxides of nitrogen and by the acid reaction of the dynamite. The nitrous odor is peculiar, and is the same as that observed when a metal is treated with nitric acid. Evolution of this gas may also be detected by the white test-paper furnished.

This paper contains potassium-iodide and starch and is turned blue by exposure to nitrous fumes. It must be well moistened before using. The dynamite may be tested for acidity by the blue litmus-paper furnished. Moisten the paper and lay some of the dynamite upon it, or place some of the dynamite in a test-tube and shake with a little water and dip the test-paper in the liquid. If acid is present the paper will be strongly reddened. If decomposition is going on it will show itself *markedly* by the above tests. The test-papers must be kept in their bottles and tightly stoppered. In the event of *active* decomposition being found to be going on, the dynamite should be used soon or thrown away. No instance has yet been noticed of this having occurred with dynamite properly made. Even an inferior article has been found to keep very well under ordinary circumstances.

Slight decomposition, if thought to occur, is of no consequence if the dynamite is not in great masses or too closely confined. As already stated, decomposition will show itself plainly enough, and therefore need not be apprehended without strong indications.

9. Examinations and observations upon the condition of dynamite must be carefully recorded and the record transmitted to the Bureau of Ordnance. The following form will be used in recording observations:

Date.	Nos.	Apparent condition.	Litmus-paper.	Starch-paper.	Remarks.
1875. Dec. 1	33, 34	Good	No effect......	No effect......	Turned out and remixed.

Transportation.

10. While carrying about, the covers of the boxes must be tightly closed to avoid leakage.

11. Dynamite should of course be handled with care, but it is not sensitive to blows or ordinary treatment, so that it may be handled freely without danger.

Use.

12. At temperatures of 40° Fahr. and below, the nitro-glycerine in dynamite freezes. In this condition firing becomes difficult, and the effect obtained is lessened. If the dynamite is frozen solidly it cannot be fired, but if it remains loose and pulverulent it may still be fired. It is therefore very desirable to use it unfrozen. If it should be frozen, it may be readily thawed by placing it in a metallic, earthen, or glass vessel, and putting this in hot water until the dynamite regains its normal condition.

13. In charging torpedoes with dynamite, use the scoop and funnel provided for the purpose, wiping them carefully before replacing them. The rods are for clearing the funnel when obstructed, and for packing the dynamite in the case. While filling, place the case on a piece of canvas, so that any scattered material may be collected. After the case is filled, wipe off the outside so that nothing may be left sticking to it. In charging, it will often be found convenient to empty the dynamite-box into the lead-lined box and charge from the latter.

14. Persons handling dynamite for the first time sometimes experience a severe headache of short duration. Susceptibility to this effect is soon lost with constant use. The headache when experienced is temporary, no permanent injury being produced.

15. Use but from one box at a time. If at any time the contents of different boxes are mixed together and the dynamite afterward returned again to the boxes, mark on each box the numbers of the boxes whose contents have been mixed together. This is necessary in order that it may be possible to trace each lot of dynamite from the time it was made until used or turned into store again.

16. Only the fuses specially supplied for the purpose must be used with dynamite. The simple powder-igniters will not fire it.

17. The force of dynamite may be considered as 6, gunpowder being taken as 1. The chief advantage of dynamite lies in the violent character (detonation) of its explosion.

18. The firing-point of dynamite is about 350° Fahr., while that of gunpowder is 600°.

19. Dynamite is not exploded by sparks or flames, but is merely set on fire, burning slowly away, leaving a white residue of silica; consequently, the ordinary precautions taken with gunpowder will be amply sufficient to prevent accident while handling dynamite.

UNITED STATES TORPEDO STATION,
Newport, R. I., November 16, 1877.

SIR: Owing to the limited appropriations and the absence of the tug Nina from the station from October to May, but little progress has been made in advancing the numerous contemplated experiments.

For the greater part of last year there could be employed only one carpenter, two machinists, one laborer (specialist) for chemical laboratory, one laborer (specialist) for electrical laboratory, one rigger and fireman at machine-shop, one painter and general shop hand, two laborers for general work, clearing away snow, &c., one teamster, four men for ferry launch, and one night-watchman.

During the presence of the class of officers under instruction this force was slightly increased, and the work of the station very much aided by the crew of the Nina.

With the force above described all torpedo-outfits for ships had to be prepared, and those returned from sea overhauled and made serviceable, when possible. The buildings, machinery, boats, &c., were cared for, and, when opportunity offered, such experiments were made as the limited force would admit, the reports of which, from the heads of departments and their assistants, will be found in their proper places.

The buildings are in good condition, the coat of oil and paint given to them has wonderfully improved their appearance, but does not effectually cover the wood, as was thought, and I would recommend that an additional coat of paint be given in the spring. This climate is particularly hard upon wooden buildings, and those on the island need extra care owing to their exposed position.

A proper coal-bin has been completed for the coal under the Bureau of Equipment.

A temporary blacksmith-shop has been built of a capacity to do small job-work, thus saving the machine-shop from the smoke which has so long disfigured it.

The torpedoes and torpedo-fittings for boats, designed by Lieutenant Converse, are now being experimented with, with, no doubt, favorable results.

The spars for the Lightning have also been experimented with, and a full report will be made thereon.

The general condition of the boats is as reported last year.

I beg the bureau to urge the necessity of an appropriation for a sea-wall on the west side of the island. During the last eight months from two to three feet in width of the island has been washed away, and every gale of wind now makes its inroad.

Owing to the protracted illness of Professor Farmer, the electrician, the results of the year's work have been considerably delayed in preparation. His report will be read with great interest, and I hope to forward soon a supplementary report, which will bring up the record of experiments to date.

Professor Hill has not accomplished much beyond the needs of the station, owing to lack of force for the desired experimental work and want of means for outside purchase.

His report embraces the results of the past year, and is very valuable.

The service igniter and fuse has undergone some slight changes, full reports of which have been submitted to the bureau.

The ability and intelligence of the officers at the station are equal to the times, and it seems a pity that they cannot be made greater use of through lack of means.

A liberal crew allowed to the Nina would contribute much to the good of the service.

As the detailed estimates already submitted to the bureau embrace all that is desired at the station, I have only to allude to them to give work in contemplation.

Respectfully, your obedient servant,

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance in charge of Station.

Commodore W. N. JEFFERS, U. S. N.,
Chief of Bureau of Ordnance,
U. S. Navy Department, Washington, D. C.

UNITED STATES TORPEDO STATION,
Newport, R. I., November 1, 1877.

SIR: In obedience to your order, I beg leave to submit the following report on torpedoes:

During the past year, owing to limited appropriations, and consequently small force employed, but few experiments have been made.

All of our naval vessels continue to be supplied with torpedo outfits from this station. A number of advantageous changes have been made in the outfit during the past year. These changes are due to the results of experiments here.

The present service torpedo seems objectionable for various reasons, principally on account of its weight, lack of strength, and the great surface offered for resistance in being towed through the water, whether ahead or abeam. A new design has been perfected; these are of steel, and possess decided advantages over the present service pattern, being stronger, lighter, and offering less surface for resistance. Their general shape is very nearly that of a sphere. Owing to the late day of their completion, they have not had a thorough trial. Another feature they possess, an advantage over the service pattern, is the mode of attaching them to the spar or outrigger; the center of the torpedo-case lies in a prolongation of the axis of the spar, and is secured to it by a conical cap permanently attached to the torpedo-case, and also of steel, which is keyed to a metal cone rigidly secured to the end of the spar; this mode of attachment reduces the surface of the spar exposed to the effect of explosion, and the force is exerted in the direction of the length of the spar, the most advantageous for the spar and the boat.

Further trials have been had with the improved spar, experimented with by Lieut. R. B. Bradford, fitted with the attachments of spans, to the forward guy and topping-lift, and it continues to give good results; tows well, preserves its immersion, vibrates but little, and has stood the fire of twelve service 100-pounder torpedoes without any material injury.

An ordinary ship's spar woolded with ratlin stuff for about one-quarter of its length from the outer end, which is also protected by a metal plate, the spar being supported by spans from the forward guy and topping-lift, has also been tried; it vibrates considerably with a speed of 8 knots (the speed of the vessel in which it has been tried), but the ability to withstand the effect of explosions has no doubt been increased.

The use of a compressor for the forward guy is an advantage, facilitating the handling of the spar after the explosion. Of the two patterns tried, the lever and eccentric is the best, being more sensitive and more readily handled.

Raising the heel of the spar, thus diminishing the immersed section and tendency of the spar to rise, and the securing the heel of the spar by a rope-lashing instead of the links and shackle now used, are advantages; the recoil of the spar being taken up by the more elastic material. A rope-lashing of six turns of 3½-inch manilla with two frapping-turns has withstood the fire of three 100-pounder service torpedoes and is not impaired.

A small iron davit, stepping at the rail convenient to the end of the spar, has been found to facilitate greatly the handling of torpedoes, and also the rigging out and in of the spar. This davit is out of the way, and when not required can be unshipped and stowed away; a similar davit, stepping in the bow of a launch, would greatly facilitate the handling of boat-torpedoes, doing away with the necessity of employing an auxilary boat for this purpose.

It has been found that, in the case of boat-spars, if the spar is left free to recoil, the effect upon the boat and spar is reduced; the spar recoils usually from 10 to 15 feet, but not past the balancing point, therefore not coming into the boat. A ready man at the heel-rope can easily, at this time, rig the spar in by a pull on the heel-rope, leaving the launch free to steam without the drag of the spar. Spars have been very successfully worked in this way at the station, and a number of spars have each withstood the explosions of six service boat-torpedoes without material injury. By this precaution the life-time of the spar is prolonged.

With dynamite the action is so different, that in experimenting with charges varying from 20 to 25 pounds, the spar has recoiled violently beyond the balancing point, landing in the boat; and in one instance was thrown over the boat into the water astern. In all cases the spar has been broken, a piece of from 5 to 6 feet in length being broken short off from the outer end.

Trials have been had with improved boat-fittings suggested by Lieut. G. A. Converse, United States Navy; these fittings are designed for the use of the same spar either ahead or abeam, and the experiments thus far have given satisfactory results. With these fittings have been tried the steel torpedoes mentioned, also the design of this officer.

Experiments have also been made with the fittings designed for fast torpedo-launches, with a view to determine the requisite strengh for a beam-spar, with good results.

A towing-torpedo capable of being towed on either quarter, or shifted from one quarter to the other while being towed, has been designed by Lieutenant Converse, and the trials had with a little working model give promise of success with a larger and more practicable one.

During the summer Captain Ericsson sent here for trial and experiment a movable torpedo propelled and controlled by compressed air; this possesses advantages of construction over the one of his design the property of the government. After a few trials conducted by the agent of the inventor, in the presence of an officer attached to the station, it was transferred to New York, where further trials have been made.

The Lay movable torpedo No. 2 was received at the station during the summer, but no experiments or trials have taken place.

There has been in course of construction here, after plans and designs furnished by the inventor, Commander J. A. Howell, United States Navy, a movable torpedo, which is rapidly approaching completion, and when finished trials will be instituted.

During the past season there has been in constant use on board the tug Nina a voltaic battery of the Converse modification of the Le Clanché type, for firing and signal purposes; it has been found to answer all requirements.

Very respectfully, your obedient servant,

J. S. NEWELL,
Lieut. and Assistant Inspector Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Station.

TORPEDO STATION,
Newport, R. I., October 31, 1877.

SIR: In pursuance of your instructions, I respectfully submit the following report upon the work of the chemical department of the torpedo station for the last year.

Our work has been very much restricted by the lack of means, so that much which I hoped to have accomplished remains undone.

In my work, I have greatly felt the need of help. Until July 1, 1876, I have had one or more assistants, but since then I have been without such aid. This want of help has been especially injurious as hindering and preventing experimental work. The routine and regular work of the department is pressing and constant, while in many directions experimental work of great value and importance remains unperformed from lack of assistance. With all there is to be done, I find almost no opportunity for experiment and work in advance. Progress is almost impossible under circumstances so cramped and limited as those of the past year.

I would earnestly press this matter upon your attention, and recommend that an assistant be again placed in this department. In past years I have been ably assisted by officers who have been attached to the station, but for some time I have not had this advantage. It would greatly help me in my work if, of those who come to the station for instructions, some could be retained for this duty who show an aptitude for experimental work.

The general and routine work of this department has been performed as usual the past year. This includes the care and handling of the violent explosives used and the general chemical work, such as testing paints, oils, glycerines, and other articles, analyzing mixed acid, preparing battery-solutions, reagents, &c. I would particularly note that there is much need of some larger balances than any in the laboratory.

The experimental manufacture and use of explosives constitute the larger part of the work of this department, outside of the instruction. As has been said (Report of November 25, 1876), our work of this kind is with the violent explosives, relating mostly to nitro-glycerine and its preparations. As far as our means have permitted, this work has been continued.

NITRO-GLYCERINE.

The method and apparatus in use at the station are fully described in the bureau publication, Notes on Explosives, and in the report of November 25, 1876, which has been referred to (Report of Secretary Navy, 1876). No essential changes have been made in them, as their working has been entirely satisfactory. In 1875, 1,600 pounds of nitro glycerine were made here; this was employed in making dynamite, which has been used as needed for various experimental work. During the months of July, August, September and October of this year (1877), 1,350 pounds of nitro-glycerine have been made, and turned into dynamite; this represents a great deal of work, as all the nitric acid required has been distilled at the station; this amount will be brought up to nearly 2,000 pounds during next month.

I would direct your attention to the condition of the buildings where work of this kind is performed; they are only a lot of old sheds, not provided with proper facilities for keeping or handling the materials used, or the nitro-glycerine and other products made here. Some improvements at least are urgently required.

The method of distilling the nitric acid employed is but tolerably satisfactory, and should be replaced by a better. Its defects are remedied as far as possible, by care in determining the *actual* composition of the mixed acid before using it. It would be better to take means for distilling a more uniform acid.

KEEPING NITRO-GLYCERINE.

I have continued to keep in magazine specimens of the nitro-glycerine made from time to time, and there are now here about 60 such specimens, running back to June, 1872. These have remained seemingly unaltered for the times they have been kept, as they show no signs of formation of free acid, or of other decomposition. It is my intention at the first opportunity to make a series of experiments on these specimens, to note if any differences in sensitiveness can be observed.

EXPERIMENTAL WORK WITH NITRO-GLYCERINE.

In my report dated November 25, 1876, I alluded to an investigation I had projected and begun upon nitro-glycerine and the reaction by which it is produced. I then expressed the hope that I should be able to carry forward this study during the year following. I regret to say that I have been unable to do this from the pressure of my duties, which has prevented me, alone as I have been, from devoting time and thought to such study. Yet this is a matter of great importance and one which ought to be fully worked out.

Although it has been shown that probably there are three nitro-glycerines or nitrins (Secretary of the Navy's report 1876, p. 168), yet I am not aware that this has been directly proved, and especially the reaction by which nitro-glycerine is formed has not been studied with a view to determine whether more than one of these nitrins may be formed in it, and if so, to point out the conditions governing the formation of these different compounds. The interest and importance of such a study, both from practical and scientific points of view, are obvious, and it is to be hoped that opportunity and encouragement will be given to its prosecution.

DYNAMITE.

All the nitro-glycerine made thus far in 1877 has been turned into dynamite; about 1,800 pounds of the latter having been prepared. This dynamite contains 75 per cent. of nitro-glycerine, but is dry enough for convenient handling. None of our dynamite has shown any tendency to lose its nitro-glycerine on keeping, under the conditions met with at the station. In all respects it is satisfactory as far as our experience goes. But I would again remark that we lack knowledge of it under more trying circumstances, and again urge the importance of testing its behavior at sea and in hot climates.

In the station-magazine dynamite is kept in wooden boxes holding 25 and 50 pounds. These boxes are specially made for this purpose and are suitable for transporting the explosive if necessary. Instructions for the care and use of dynamite have been drawn up, a copy of which accompanies this report.

Experimenting with dynamite has been greatly limited by the lack of means.

A number of experiments have been made on the firing of frozen dynamite. These are detailed in my report dated April 30, 1877, a copy of which is appended and to which I would refer. It is very desirable that these experiments should be continued, as they are yet incomplete. Since the experiments just spoken of were made I have had a case in which frozen dynamite was not fired, although the conditions were like those in other cases when explosion occurred. The subject is evidently of great importance, since in our Northern waters dynamite will often be frozen and remain so for considerable periods. As I have remarked at another time, it is highly probable that differences in readiness of firing when frozen may be found in dynamites made at different times, so that it is necessary to obtain some certain means of explosion. I intend to continue these trials this winter and hope to finish them.

In this connection I would again bring up the subject of experiment on the comparative force of explosive agents. The very interesting experiments begun in 1874 have not been continued. They promised to yield valuable results, but we have been unable to go on with them from the want of means.

Some preliminary trials have been made of another method of comparing the force of explosive bodies, which were very satisfactory, and it is designed to prosecute the work when possible. I would recommend that the facilities required for this should be afforded.

A series of experiments to determine the distance at which dynamite will be exploded by concussion from firing another charge in air and water has been planned.

GUN-COTTON.

A quantity of English-compressed gun-cotton is at the station, but as yet little has been done with it. It is desirable that this material should be experimented with, and in comparison with dynamite. It will be necessary to make a suitable fuse for it.

PICRIC POWDER.

In my report of November 25, 1876, I summarized the experiments which had been made with picric powder, and stated that it was proposed to continue them by trying powders of varying composition. For this purpose a quantity of ammonium picrate had been prepared in the station laboratory. Since then nothing has been done in this direction. I would earnestly recommend that the subject be taken up again, and that the experiments in connection with it be performed. The plan proposed is stated in my report dated August 21, 1875.

If this picric powder is found to possess the properties claimed for it, it will be very serviceable as a shell and torpedo powder.

LIQUID CARBONIC ACID.

The method in use at the station for preparing this substance in large quantity and the construction of vessels to contain it are described in my report of November 25, 1876 (Report of Secretary of the Navy, 1876, p. 174). In this report the statement is made that a vessel built upon the plan there described is not likely to burst explosively, but if strained beyond its endurance it will gradually yield until an opening is made and the pressure relieved. This opinion has now been confirmed in practice. Two flasks were charged with the liquefied gas in December, 1876, and remained until August, 1877. One was then emptied, as it was necessary to remove its valve. The other was kept charged until on August 17, 1877, it was found that gas was escaping from it. Examination showed that a partial separation had occurred at the junction of one of the heads with the body, causing a large leak. The weakness of the vessel being thus indicated, its valve was opened and the gas remaining in it discharged. The probable cause of this yielding is that this flask was weakened by being exposed to excessive and long-continued strains applied to test a mode of securing the valve pieces. The flask has been since perfectly repaired.

I would again call attention to the opportunity for important and interesting experiment in connection with liquid carbonic acid. We are able to make easily large quantities of this substance, and can therefore operate on a large scale. Some time since (July 5, 1875) I submitted a plan for making an elaborate series of observations of the tension of its vapor at different temperatures and its behavior under varied conditions. Other investigations have been suggested. I earnestly recommend that the means be granted for prosecuting such studies.

INSTRUCTION.

As heretofore, the instruction of the officers ordered to the station for that purpose has made up a large part of the duty performed. The usual course occupies three months, but this year a portion of the class arrived June 1, the remainder coming July 1, so that instruction was carried on during four months.

The system followed in this department has been essentially the same as in 1876; lectures on general chemistry and on the chemistry of explosives, appropriately illustrated and accompanied by practical work and experiment. As before, the officers under instruction were required to answer regularly, in writing, questions covering the subjects of the lectures.

I have already submitted to you a list of the topics treated in both courses of the lectures.

Some additions are required to the apparatus and other means of illustration and experiment in connection with instruction.

Unaided as I have been this last summer, I have not been able to make the course of instruction as full and satisfactory as I wished. I have not had time to elaborate the lectures themselves or to prepare experimental work, as I wished to do; but if the plan of instruction which has been adopted for two years is still adhered to, I shall aim to improve and complete that portion which is assigned to me. I think that experience has shown that this method is the best one applicable.

Very respectfully,

WALTER N. HILL,
Chemist.

Capt. K. R. BREESE, U. S. N.,
Commanding Torpedo Station.

UNITED STATES TORPEDO STATION,
Newport, R. I., October 25, 1877.

SIR: The course of instruction during the present year has been substantially as it was in 1876. The attention, diligence, and progress made by the students has been very commendable.

Besides the instruction given to the class, the officers of the station have continued the investigations which were commenced last year, having for their object to determine the relative value of different magneto-electric machines for the production of electric light.

Owing to my protracted illness, these experiments have not been concluded nor their results fully determined. It is to be hoped that during the coming winter this end may be accomplished.

The machines that have been under examination are the large and small Gramme, the Wilde, the Heffner-Altenek as built by Siemens Bros., and the Farmer dynamo as built by the Messrs. Wallace and Sons.

Experiments have also been conducted with the Serrin lamp which accompanies the Gramme machine, with the non-automatic lamp furnished by Mr. Wilde, with the automatic lamp furnished by Siemens Bros., with an automatic lamp built by the Messrs. Wallace and Sons, with two automatic lamps built by Mr. Farmer, and also by one new automatic lamp of his construction which was furnished for use on the torpedo-boat Lightning, to be operated by the small Gramme machine.

One of the objects sought to be attained was to determine the relative efficiency of these various machines, *i. e.*, to determine what fraction of the mechanical power applied was converted into current electricity.

By reference to the text-books of Jenkins and Maxwell on electricity, it will be seen that the dimensions of an electro-magnetic resistance are the same as those of a velocity, viz, $\frac{L}{T}$ = a length divided by a time. So a strength of current may be expressed as the square root of a force or $S = \sqrt{F}$, or as the square root of the product of a length and a mass; and this product divided by a time, then $S = \sqrt{F} = \frac{\sqrt{LM}}{T}$. So too an electro motive force, since it is the product of a resistance multiplied by a strength of current, will be expressed thus: $E = RS = V\sqrt{F}$ or an electro motive force is of the same dimensions as a velocity multiplied by the square root of a force, or in units of length, mass, and time, $E = \frac{L^{\frac{3}{2}} M^{\frac{1}{2}}}{T^2}$; and finally electric power or $ES = RS^2$ will be of the same dimensions as mechanical power or $V\sqrt{F}\sqrt{F} = VF$ equal to a velocity multiplied by a force or $= \frac{L^2 M}{T^3} = \frac{V^2 M}{T}$ square length multiplied by a mass and divided by the cube of a time.

With these preliminaries we shall see that a volt multiplied by a weber (farad per second) will equal nearly 44¼ foot-pounds per minute.

Expressing the absolute units in meters, grams, and seconds, and the more familiar mechanical units in foot-pounds, and minutes, we have.

$$p = \frac{12}{9.81} \times \frac{(10^5)^2}{10^7} \times \frac{15\,432}{7000} \times \frac{3.2809}{1} \times \frac{60}{1} = 44.24,$$

or multiply volt-webers by 44.214 to get their equivalent in foot-pounds per minute, or by $\frac{44.24}{3300} = .00134$ to get an equivalent in horse-powers.

With this understanding, in order to determine the efficiency of any magneto-electric machine we measure the resistance of the circuit in which it is acting; observe the strength of current produced by the machine, and note also the H. P. applied to drive it. Its efficiency is then $\frac{.00134\,R\,S^2}{\text{H. P.}}$.

By the inverse method it would be easy to ascertain the efficiency of any form of electro-magnetic engine by noting the strength of current active in driving it—measuring the resistance of the whole circuit, and also the mechanical power evolved by the combination O, the efficiency, expressed thus:

$$O = \frac{\text{H. P.}}{.00134\,R\,S^2} \text{ or } \frac{745.93 \text{ H. P.}}{R.\ S^2}.$$

We will first examine the large Gramme machine. This machine weighs about 2,700 pounds, stands 30 inches high, is 40 inches long, and 34 inches wide; it is driven by a pulley 15 inches in diameter. The mechanical execution of this machine is excellent. The armature moves with very little friction, about 19 foot-pounds per revolution. The field of force-coils are flat. There are four of these, each about 10 inches long, 3¾ inches deep, and 22 inches wide. The wire is of such size as to pack about 6 spires per linear inch. The armature resistance is .129

ohms, the field resistance .212, thus making .341, little more than $\frac{1}{3}$ or an ohm for the total internal resistance of this machine. The armature is wound with a flat wire nearly 17,000 inches in length, disposed in 828 spires, and weighing 126 pounds. The field of force-coils aggregate a length of 19,000 inches, disposed in four multiple arc circuits of 472 spires each, or 1,888 in all, and weighs 357 pounds, making the total weight of wire in the machine 483 pounds. Here the weight of wire is equal to nearly $\frac{18}{100}$ (p. c.) of the total weight of the machine. There is but one commutator, consisting of 134 divisions, upon which press two wire brushes or collectors.

I will digress a moment to describe the dynamometer used. It is known as Neer's dynamometer, and consists of a shaft with one fast and one loose pulley and a movable cross-head; a pair of rollers are attached to one pulley and a pair of inclines to the cross-head, a spiral spring encircles the shaft, and the reaction between the driving and driven belts causes the rollers to mount the inclined planes and thus compress the spring; one end of this spring is attached to a pointer protruding from the shaft, on this pointer is a scale divided into thirty-seconds of an inch. The diameter of the pulleys is 16½ inches; a strain on the driving belt of 4.966 will compress the spring $\frac{1}{32}$ of an inch; as a mean of many experiments there to get the H. P., we multiply the number of revolutions per minute of the dynamometer shaft by the number of 32d expressed on the scale, and finally multiply this product by .00065, and we have the horse-power at any moment; thus, H. P. $= .00065\, p\, V_D$.

I here subjoin a table of experiments.

Column 1 contains the velocity of the dynamometer.

Column 2 that of the machine.

Column 3 the pressure on the dynamometer spring in 32d of an inch protrusion.

Column 4 the deflection of the galvanometer θ_2'.

Column 6 the resistance of the galvanometer circuit, which is used as a shunt to a small resistance which is in that part of the circuit in which the machine is placed.

Column 5 is the more exact value of this small resistance. These two resistances were measured at the close of each experiment.

Column 7 is the sum of all the resistances in the circuit.

Column 8 is the strength of current developed in the circuit and is

$$S = \frac{R_g + R_s}{R_s} \times a \times \tan \theta_2' (a = .015).$$

Column 9 is the electro-motive force or the product of the numbers in column 7 by those in column 8.

Column 10 is the product of columns 8 and 9 multiplied by the factor .00134, and expresses the developed electric energy in horse-power.

Column 11 is the product of the numbers of column 1 and column 3 multiplied by the factor .00065, and expresses the horse-power actually applied to drive the machine.

Column 12 is column 10 divided by column 11.

Column 13 is column 9 divided by column 2, and shows the electromotive force in function of the velocity. This is some (as yet unknown) function of the total resistance in the circuit.

From an examination of this table, I infer that, within these limits, the electrical force averages 108½ volts per 1,000 revolutions per minute of the armature, provided the total resistance in circuit does not differ greatly from 1¼ ohms.

From column 12, I infer that the efficiency of the machine may be safely set down as 68 per cent., although it seems to vary between 60 and 75.

	1	2	3	4	5	6	7	8	9	10	11	12	13
	V_d	V_m	p	θ'_2	R_s	R_g	R	S	E	JES	P	$\frac{Jes}{P}$	$\frac{E}{V_m}$
			'	° '									
1	318	360	8.	41. 50	. 105	185.	1. 642	23. 67	38. 86	1. 232	1. 658	. 739	. 108
2	314	378	8. 25	41. 59	. 105	195.	1. 662	25. 08	41. 68	1. 045	1. 684	. 620	. 110
3	348	389	10. 1	41. 59	. 107	235.	1. 477	29. 54	43. 63	1. 728	2. 284	. 756	. 112
4	347	387	12. 3	41. 56	. 114	283.	1. 282	33. 46	42. 89	1. 923	2. 774	. 693	. 111
5	338	362	14. 2	42. 00	. 128	333.	1. 069	35. 15	37. 57	1. 769	3. 119	. 567	. 103
6	327	357	17.	42. 07	. 127	409.	. 879	43. 68	38. 39	2. 247	3. 613	. 621	. 107
7	336	352	21. 5	41. 49	. 125	549.	. 675	58. 94	39. 78	3. 142	4. 551	. 689	. 113
8	346	386	7. 5	......	. 200	329.	1. 737	22. 22	38. 59	1. 283	1. 686	. 682	. 100
9	322	367	10. 3	......	. 201	439.	1. 357	29. 24	39. 68	1. 555	2. 156	. 721	. 108
10	343	373	13. 5	......	. 220	559.	1. 167	34. 53	40. 29	1. 864	3. 009	. 619	. 108
11	336	380	13. 5	......	. 220	559.	1. 167	34. 53	40. 29	1. 864	2. 948	. 632	. 106
12	322	366	20. 1	......	. 210	859.	. 762	58. 64	42. 46	3. 166	4. 207	. 752	. 116
Average	......	......	......	......	......	......	......	......	......	......	......	. 681	. 1085

The small Gramme machine stands about 18 inches high, 20 inches in length, and 13 inches in width. There are two commutators of 50 divisions each. The wire in each armature weighs 9 pounds, disposed in two distinct circuits; one has an internal resistance of .306, the other .335 ohm; aggregate, .641 ohm. The field of force has force-coils of an aggregate weight of 34 pounds, and an aggregate resistance of 1,317 ohms, so the total internal resistance of the machine is .641 + 1.317 = 1.958, nearly 2 ohms, and at a velocity of 1,800 turns per minute it yields from 300 to 400 c. l. I have not yet measured the power required to drive it. It is probably between one-half and one horse-power.

Thirdly, the Wilde machine: this resembles in some measure the Hyerth machine of 1855, only that its field is wholly electro-magnetic, no permanent magnets being used in its construction. Its armature wire weighs 28 pounds, and is divided into two circuits, about 7 pounds of it, having resistance of .454 ohms and connected to a commutator, furnishes a current and serves to maintain the field. The remainder of the wire, 21 pounds, offering a resistance = .074 ohm has no commutator, but is connected to two bands upon which press two springs or collectors, the springs serve as conductors to deliver a to-and-fro current to the lamp.

About 325 pounds of wire are distributed into 24 coils to make up the electro-magnetic field, which has R_s = 2.83 ; these coils are 10¼ in length and 3⅞ external diameter, having soft round iron cores 2 inches diameter. There are 24 armature cores and coils, one-half on each side of a central cast-iron wheel 1½ inches thick. The central diameter of this wheel is 18 inches nearly. The total resistance of this field of force, as arranged, is 2.83 ohms. Thus the whole weight of wire used in this machine is not far from 354 pounds. When carefully adjusted and running at a speed of 600 revolutions per minute, with good carbons, it has given as much as 3,000 c. l.

The interaction of the armature circuits is such that when the light circuit is closed with external resistance less than $\frac{1}{10}$ ohm, less power is required to drive the machine than when the light circuit is open, as will be seen from the subsequent experiments.

The following is a list of experiments tried October 10:

V_D	V_m	p	S	P	
342	533	12.5	5.14	2.778	Carbons in contact.
370	510	15.5	5.28	3.727	Short arc.
345	467	19.5	6,13	4.246	No arc.
355	514	16.2	5.28	3.738	Short arc.
317	447	24.0	6.21	4.940	R = 1.97.
335	483	19.2	....	4.180	No arc.
340	496	19.5	....	4.310	No arc.

On October 14 the pulleys were so changed as to give the machine a greater velocity relatively to the dynamometer. A single experiment gave

V_D	V_m	p	P
447	650	13	3.77

On the 16th October, experiments were tried to ascertain what would be the power required to drive the machine when the field was maintained by a current not from itself, but from another machine. This new current was maintained constantly at 6 webers strength, being a little more than the average field-current furnished by the machine itself in the experiments of October 10.

Four experiments were made in the day-time, October 16, as follows:

V_s	V_m	p	S	P	
450	620	16.75	6	4.89	No arc.
450	640	16.5	6	4.82	Short arc.
487	685	11.7	6	3.70	Carbons in contact.
454	625	17.8	6	5.25	R = 1.97.

The total resistance of the field being R = 2.83 the theoretical energy expended on the field by a current of 6 webers strength, would be $44.25 \times 2.83 \times 6^2 = 4508$ foot-pounds per minute = .136 H. P.

But we find that when there was no arc, both armature circuits being open, it requires 4.89 H. P. to maintain a speed of 620 revolutions per minute. This consumption of forces is due to the work done on the iron cores of the armature by the "Ampère" currents set up in them by their alternate magnetization and demagnetization at the rate of $620 \times 12 = 7440$ times per minute. This is soon noticed by the rise of temperature in the armature after it has been a little while at work. In the evening of the 16th three other experiments were tried. In the first two the field was maintained by this same extraneous current as in the day-time, but in the third experiment it was maintained by its own appropriate armature circuit. The results are given below:

V_D	V_m	p	S	P	
466	680	12.5	6	3.78	L = 576.
440	641	13.8	6	3.87	No arc.
470	632	13.4	....	4.09	L = 576 to 600.

From the first one of these experiments it appears that it actually took less power to drive the machine when giving 576 c. l. than in the second experiment when doing no external work. In the third experiment the current was not observed, but it could not be far from 6 vebers—possibly a little greater.

Further experiments are contemplated in order to determine the net power converted into light abstraction being made of the power required to supply the magnetic field.

Fourthly, the Heffner-Altenek machine, as built by the Siemens Bros.: this machine is 61 inches in length, 28 inches in breadth, and 12 inches in height. It is of that class in which there are no moving masses of iron subject to magnetization and demagnetization. Its field of force is furnished by two groups of 16 bars each, of wrought iron, slightly curved in the middle portion so as partially to surround the armature. Each of these bars is 1 inch in thickness and 2 inches in breadth and 28 inches in length. These two groups are connected at each end, the one to the other, by slabs of cast iron 34 inches in length on outside of the machine. The curvature of these bars is such as to surround and be nearly in contact with perhaps two-thirds of the periphery of the armature; each end of each group of field of force-bars is surmounted with a spool of insulated wire. This wire is .115 inch diameter, and the amount on each of the four spools is nearly 95 pounds. The four spools are connected in multiple arc, and their conjoint resistance is nearly .48 ohms.

The armature is something over 34 inches in length, and 9½ inches external diameter; it is formed by winding 98 pounds of two insulated wires of .119 diameter longitudinally and in eight divisions around a thin and hollow brass cylinder. Within this hollow cylinder is a hollow stationary cylinder of cast iron supported by bearings that pass through the above-mentioned brass cylinder, and of course the bearings on which the brass cylinder turns must likewise be hollow. The commutator has 8 divisions, which are 8 sector-shaped sheets of brass insulated from, but attached to, the face of a plate which is outside of one of the bearings of the brass cylinder.

Two collector-springs or brushes trail upon and press against these sectors; these brushes have a bearing so extensive as to short circuit or bridge over the edge of two sectors, while changing from one to the other, and thus practically preserve the continuity of the circuit. The spark at the commutator is quite insignificant considering the great strength of current (often more than 50 webers) and fewness of divisions to the commutator.

It will be seen from this description that this machine differs from all the others above mentioned in this point, viz: The armature simply moves a wire through a field of force which is produced by the wrought-iron bar magnets of the field excited by the field of force-coils. The intensity of this field is heightened, too, by the induction of the central and stationary cylinder of iron, this being magnetized by the induction of the field of force-bars.

There being no iron in this machine to be alternately magnetical and demagnetical during the armature's rotation, and consequently no energy uselessly expended in that process, we should expect this machine to give the highest duty of any of these here enumerated, and such we find to be the case, as will be seen from Table No. 2, Siemens, July 17, 1877, where it appears to average .729 for its efficiency, while the mean of 12 results on the Gramme was only .681. With the Siemens machine making 350 to 400 revolutions, the light given out would vary from 4,500 to 5,000 c. l.

TABLE No. 2.

V_D	V_m	p	θ'_2	R	R_g	S	ER	RS^2	JES	P	$\frac{JES}{P}$
			° ′								
300	287	18.5	41.40	.21	623	39.47	1.345	2047.6	2.744	3.607	.761
328	314	21.0	42.29	.21	623	40.65	1.366	2257.1	3.024	4.477	.675
320	297	19.5	42.45	.21	623	40.95	1.360	2290.5	3.055	4.055	.753
Average											.729

An interesting experiment was tried to enable me to form some approximate estimate of the net power expended on the armature circuit while producing a light. To this end a current of from 25 to 33 webers was passed through the Siemens field, such current being furnished by the Gramme machine, while the current furnished by the Siemens armature embraced only the leading wires and the lamp external to itself. This being the arrangement, the Siemens armature making some 380 revolutions per minute, the light given out varied between 6,241 and 8,177 c. l., according as the velocity changed and the arc varied in length. The power expended on the armature varied from 5.05 to 5.37 H. P.

But by a previous experiment I find that 3.07 H. P. was expended in driving the armature 462 revolutions per minute, even where the arc was broken and there was no light. This was owing to the adjustand construction of the armature commutator and brushes; had there been more division to the commutator and armature and a better adjustment of the commutator, there would have been less loss.

This difference, 5.37 — 3.07 = 2.3, or 2.3 H. P., was actually consumed in producing at times 8,100 c. l., or more than 3,500 c. l. per H. P., as the amount that could be produced from a similar armature revolving in a field of equal strength and produced by permanent steel magnets. This would correspond to, say, 9½ foot-pounds per minute as the net cost in energy of one c. l. Elaborate experiments made on the combustion of gas, by Prof. Jules Thompson, of Copenhagen, some years since, led him to the conclusion that 1 c. l. represented nearly 13 foot-pounds of energy per minute; so two certain experiments by Prof. W. B. Rogers with an electric light of 13,000 candles produced from 500 powerful Bunsen cells enabled me to reach the conclusion that 1 c. l. was the equivalent of from 12 to 13 foot-pounds per minute.

Unless especial care be taken in preparing and using the carbon points, great variation in the intensity of the light will occur.

When the current of the Siemens armature was passed through its own field, the total internal resistance being then .58 ohm, and the remaining resistance being only that of the arc, and probably $\frac{1}{20}$ ohm for leading wires at 375 revolutions and 31 divisions pressure on the dynamometer, and the armature making 348 revolutions, the power consumed was 7.55 H. P., and the light ranged in the vicinity of 5,000 c. l., sometimes exceeding and sometimes falling short of that amount.

The size of wire on this machine is such that it will bear to be driven from 400 to 500 revolutions per minute, and it can be made to give a light exceeding 12,000 candles.

I come next to the machines built by Messrs. Wallace & Sons, one of which was sent to this station at the request of the Bureau of Navigation for the purpose of having its suitability for electric-light signaling examined into. A description of this machine will be found in the report of experiments made with a view of determining its relative efficiency. From an inspection of Table No. 3, here subjoined, it would appear that as the result of three experiments its efficiency in converting mechanical into electrical power may be set down at 50 per cent.

TABLE No. 3.

V_D	V_m	p	θ'_2	R_e	R_g	ER	S	E	ES	JES	P	$\frac{JES}{P}$
			° ′									
342	758	20.25	41.21	.219	204	10.404	12.31	130.65	1601.	2145	4.56	.47
347	765	18.25	41.39	.206	200	8.764	12.96	126.54	1640.	2197	4.116	.53
345	747	19.	41.37	.206	194	9.884	12.53	124.65	1557.	2086	4.26	.49
Average												.50

Comparing now the efficiency of the three types of machines, viz, the Siemens, the Gramme, and the one built by the Messrs. Wallace & Sons, they will be found to range themselves as follows:

Machines.	Efficiency.
Siemens	.729
Gramme	.681
Wallace	.500

A few words may be said in reference to the various lamps experimented with.

First, the Siemens lamp. This is automatic in its action. An electro-magnet in its base, with circuit-shutting arrangement causes an armature to vibrate when the current is too strong, and this by means of a ratchet and wheel-work separates the carbons to such a distance as shall give a suitable arc. The weight of the upper carbon and holder causes the carbons to tend to approach each other, but, as they move together, the arc is shortened, the current is increased, and the vibrating armature again separates the two carbons. When properly adjusted and supplied with a current of 40 or 50 webers strength, the performance of this lamp is admirable. The lamp is so constructed that by simply turning a button it can be adapted to a to-and-fro current, but turning the button in the opposite direction adapts it to a current of one direction only. This lamp works best with the latter arrangement.

The Serrin lamp is an admirable one, works smoothly and uniformly, and gives a very steady light. So, too, does the Farmer lamp, that was used for signaling in some experiments made for Commodore F. A. Parker last autumn. This lamp seems best adapted for signaling purposes of any of those that have been tried at this station. It has been run for three hours or more without once going out. A shutter arrangement was fitted last year to this lamp, which proved very effective for signaling either by a succession of flashes or by a succession of obscurations. The succession of flashes is much to be preferred according to the experience at this station.

A small non-automatic hand-lamp constructed by Mr. Farmer, for use on the torpedo-boat Lightning, has proved very advantageous as a means of signaling when its beams have been waved in the sky in a manner somewhat similar to the usual method of waving a signal-flag. In dark and cloudy nights this method of signaling has some advantages, since the position of the lamp can be screened, as for instance by being sunk in a rifle-pit, so that its exact location could not be determined at a distance. The non-automatic lamp of Mr. Wilde is a good one for such a method of signaling.

The automatic lamp made by the Messrs. Wallace & Sons has not given so good satisfaction for signal purposes as was hoped, principally because of the intermittent character of the light. The feeding mechanism for the carbons is such that it allows the carbons to burn away until the arc becomes quite long, then, the current having become much weakened, the carbons rush suddenly together, nearly putting out the light, which, however, soon regains its former brilliancy. But this wide variation in the intensity of the light is prejudicial to its use as a means of signaling. With proper care bestowed on its adjustment it has given fair results for the purpose of general illumination, saving the unpleasant variation in the intensity of the light.

The carbons furnished by the Messrs. Wallace & Sons are very excellent; none better or even so good, from any other source, have been brought to our notice.

Some experiments have been tried with parallel carbons arranged somewhat after the plan of the carbons in the electric candle of M. Zablochkoff, but sufficient experiments have not yet been tried to warrant an expression of opinion as to the serviceableness of carbons used in that manner.

Experiments have been continued with the platinum lights, but no newer results are ready for publication.

Lieutenant McLean tried some interesting experiments in the endeavor to diffuse the electric light by rotating the lamp rapidly about a center eccentric to the light, suggested no doubt by the well-known experiment of whirling a lighted torch in the air. The experiments were not carried sufficiently far to develop any useful results.

A novel and useful method of diffusing the electric light and removing the painful glare usually present with a powerful arc has been adopted for the illumination of the workshop. It is as follows: A cylindrical screen, formed by stretching a few yards of cloth around an upper and under hoop of iron wire, which hoops should be from three to five feet in diameter, is placed around the electric lamp, the top hoop being, say, one and a half or two feet above the level of the carbon points of the lamp, and the lower hoop of the screen being as much below the lamp. This screen serves to soften and nearly obliterate the sharpness of the shadows usually experienced with the light from a powerful electric arc. With one such source of illumination, and still better with two lamps, it is found practical for machinists to continue their work by night even better than by the light of an ordinary cloudy day.

Two lamps giving 1,200 to 1,500 candle-light each serve to amply light a shop 42 feet wide, 72 feet long, and 18 feet high, and this amount of light can be furnished at an expense of three or four H. P. expended on the best machines, and with good lamps burning the best of carbons.

The various batteries in use last year have been carefully examined and tested this year. Some cells of gravity battery have been up a year and a half, always ready for use, and requiring only the addition of water to replace that evaporated. The usual form of the Le Clanché battery has given place to the improved form designed by Lieut. G. A. Converse, which has given the highest satisfaction, some cells of it having now been in use a whole year without replenishing. Nothing better for use on shipboard has thus far appeared.

The station battery has fully sustained its reputation for torpedo-work; its constancy, durability, and power cannot well be surpassed.

The careful insulation attained by thoroughly coating with paraffine the shelves on which these batteries are placed contributes greatly to the durability of its current. All our battery-shelves are now coated with paraffine; so, too, are the tops and bottoms of the jars of the gravity battery cells.

The "Waffle" or "Tray" cells have been in constant use connected with the Converse circuit indicator, and their performance has been in the highest degree satisfactory. Three Waffle cells supply with current the closed circuits of ten of Converse's indicators, and have never failed.

The Converse circuit indicator has continued to give the best of satisfaction, indicating unerringly at every instant the condition of the battery and of the ten circuits which they supply.

The cables used with these indicators, which are the Siemens copper-sheathed cables, begin to show signs of wear. It was not expected of them to endure as long as they have lasted. They should now be replaced by cables more heavily armored.

The kerite wire that was put down in lead pipe in 1875 maintains well its condition of insulation. While a portion of the kerite which was buried without the lead-pipe protection has proved defective, seeming to have become absorbent of moisture, one or two of these wires needed to be taken up and repaired on account of leaks that developed themselves during the latter part of the summer of 1876. The various samples of kerite thus far supplied to the station differ widely in the quality of durability; some samples that have been at sea two or three years, and so, too, some samples in store and in use at this station for that length of time, and even longer, are as good now as at first, while other samples have materially deteriorated. Evidently the process of covering or the materials used in its composition are productive of very varied results as to durability.

From the experiments made last year on the various electric unions, it has seemed best to adopt the soft-rubber tubing in preference to the other and more elaborate unions of Lieutenant Bradford and of Mr. Wilkes.

Zincs for the gravity-batteries have been furnished by the Newport Manufacturing Company which did not give so good results as those furnished by W. Blake & Co., of Boston, even though made from professedly the same quality of metal. Some few had about 1 per cent. of antimony introduced with the zinc for experimental purposes, but, as was expected, the results were not satisfactory.

The United States steamer Trenton was fitted with an elaborate firing apparatus designed at this station, a more full account of which will be found elsewhere.

Lieut. T. C. McLean has devised a very ingenious apparatus for steering a ship's launch; some few experiments have been tried with it, but this series of experiments is not yet concluded.

Some improvements in the arrangements for permanent wires on shipboard have demanded attention, and the simple form of wire terminals designed by Lieutenant Converse has been adopted in the service. Lieut. G. A. Converse's perfected electric primers give the highest satisfaction for the firing of guns either singly or in broadside.

Experiments have been made with the telephone in order to ascertain its suitableness for communication between the bridge and the powder-magazine, as well as between other parts of a ship. These experiments are now in progress with prospects of success.

It has been found possible to communicate over a circuit of 22,000 ohms, having a stated capacity of 8 microfarads, whence it is easy to see that it would be entirely feasible to communicate through an ocean-cable between two stations that should be at least 500 miles apart. The rapadity of communication, too, is astonishing, since 145 words in 17 seconds were distinctly heard over a short circuit. This is at the rate of 512 words per minute. The possibility of communicating with way-stations at a distance from the direct line, and without a loop, has been satisfactorily demonstrated by Mr. Farmer with the aid of his assistants.

The experience of the past two years has demonstrated that the method of measuring battery resistances devised and used at this station is the most satisfactory known. By it we are able to obtain results agreeing within one-half of one per cent. of each other, even in the case of batteries that are quite inconstant.

This method is founded on the well-known shunt method, which depends on this principle: If a rheostat open to a great resistance and a galvanometer of fine wire and large resistance be introduced into the circuit of a galvanic battery, a deflection of the needle will be obtained, caused by the current from the battery, which current will not be large if the resistance of the circuit be great, but which will give a sufficiently large deflection if there be many windings or spires of wire on the galvanometer. If the resistance of the galvanometer be equal to that to which the rheostat be opened, and if we should shunt out or remove from the circuit the rheostat resistance, the needle would show a greater deflection than when the rheostat was in circuit. If we should next place a shunt across the poles of the battery, this shunt, having a resistance just equal to that of the battery, we should find that the needle would return to the same deflection at which it stood originally when both the galvanometer and rheostat were in the circuit.

While working this method, it occurred to Lieut. A. R. Couden that if both these changes were made simultaneously, viz, placing a shunt across the poles of the battery, and cutting out the original rheostat resistance, the needle would not alter its position if the shunt resistance were equal to the battery resistance.

Mr. Farmer devised and constructed a key by which, with the use of a single lever, both these changes were simultaneously made, and by the use of this apparatus all our most satisfactory battery measures are now made, as likewise were many of those found in the tables appended to my report of last year.

I would here earnestly renew my appeal, made last year, for a new switch-board of better construction than the one now in use.

MOSES G. FARMER.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Station.

A.

BUREAU OF NAVIGATION, NAVY DEPARTMENT,
Washington, November 10, 1876.

SIR: The bureau, being desirous of having the Wallace electric light tried, to ascertain its suitability for signal purposes, has this day addressed a letter to the manufacturers, Messrs. Wallace & Sons, Ansonia, Conn., that, if agreeable to them, they are authorized to send one to you for trial, to be returned when asked for by the company or when no longer desired, and, if retained, to be paid for at a price to be named on acceptance of the authority for trial.

If this proposition is accepted by the company, you will have the light carefully examined and tested, and report made to this bureau.

You are also informed that this arrangement is in accord with the views of the Chief of the Bureau of Ordnance.

Very respectfully, your obedient servant,

DANL. AMMEN,
Chief of Bureau.

Capt. K. R. BREESE, U. S. N.,
Commanding Torpedo Station, Newport, R. I.

B.

UNITED STATES TORPEDO STATION,
Newport, R. I., January 17, 1877.

SIR: You are herewith appointed a board to examine and report upon the magneto-electric machine and lamp sent here by Messrs. Wallace & Sons, of Ansonia, Conn., by direction of Commodore Daniel Ammen, Chief of the Bureau of Navigation, for the purpose of ascertaining its suitability for signal purposes. In this connection you will please ascertain the following:

First. The horse-power required to drive the machine, noting the revolutions per minute, the amount of light produced, and the amount of electricity in volt-webers acting in the circuit at the time the light is burning at its best adjustment.

Second. Determine the efficiency of the machine; that is, what portion of the power applied is converted into electricity.

Third. How many candle-lights can be obtained from the lamp per horse-power applied.

Fourth. Determine the light-producing power of the machine in function of the power applied and weight of wire employed in the construction of the machine.

Fifth. Also, the efficiency of the machine and lamp in function of the velocity at which the machine is driven.

If it will not take too long, ascertain what is approximately the best velocity at which the machine should be run.

You will be particular to note any peculiar advantages or defects in the construction of the machine and lamp, and make such suggestions as you may think proper in reference thereto.

Please to bear in mind that the machine and lamp is intended for signaling, and, after having given the above due consideration, report to me in detail the experiments, and your opinion as to its suitability for use on shipboard.

Accompanying this is a copy of the order for trial of Commodore Daniel Ammen, Chief of Bureau of Navigation, the order of the Chief of Bureau of Ordnance, and the letter and directions of Wallace & Sons, of Ansonia, Conn., concerning the machine.

Very respectfully,

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance, in charge of Station.

Prof. M. G. FARMER,
Lieut. G. A. CONVERSE,
Lieut. A. R. COUDEN.

C.

ANSONIA, CONN., *January* 9, 1877.

DEAR SIR: We have this day shipped to your address, per order of Com. D. Ammen, Chief of Bureau of Navigation, one magneto-electric machine-lamp and reflector complete, and trust it will arrive safely and prove satisfactory.

Yours, &c.,

WALLACE & SONS.

K. R. BREESE,
Commandant U. S. N. Torpedo Station.

ANSONIA, CONN., *January* 16, 1877.

DEAR SIR: Herewith find memorandum of instructions to assist in a proper manipulation of the lamp which accompanies the magneto-machine sent you for experiment, and which we trust will help you to get effective and satisfactory results.

Yours, &c.,

WALLACE & SONS.

Captain BREESE, U. S. N.

Electric lamp, manufactured by Wallace & Sons, Ansonia, Conn.

In this lamp the lifting-power of the magnet is such as will insure a good separation of the carbons with any amount of current which will produce a good light. Should stronger currents be used, the increased power of the magnet is contracted by the addition of weights to the top of the upper carbon-carrier.

To this end find a pin upon the top of the rod on which said weights are dropped. (Said pin is removed for convenience in packing.)

The separation of the carbons by the action of the magnet is governed by a stirrup attached to the top of the central column and adjustable by a screw.

This stirrup not only governs and limits the separation, but also prevents all irregular motion of the carbons through sudden variations of the strength of the current.

To break the circuit, raise the upper carbon.

To do this, hold the free end of the stirrup down to its seat, and the carbon-carrier will slide freely in its socket.

These parts may be handled without danger of shock, as the central column and its attachments are in circuit with the upper carbon.

The upper carbon travels at double the speed of the lower one, and if the current traverses in the right direction (*i. e.*, from the top to the bottom), it will maintain the light at a fixed and constant elevation.

When burning properly the point of the *upper carbon* will appear the hottest, as it consumes the fastest.

The base of the lamp is provided with a switch for changing the direction of the current, or breaking it without severing connection with the conducting wires.

To use said switch, first and invariably separate by the hand the points of the carbons. Then move the switch levers as may be desired.

To break the circuit at the switch in neglect of this precaution destroys the anvils from the great heat produced by the primary interruption of the current solely at these points.

NAVY DEPARTMENT, BUREAU OF NAVIGATION,
Washington, June 5, 1877.

SIR: The bureau would be pleased to learn whether any experiments have been made with the magneto-electric light machine which was sent to the torpedo station some time ago by Messrs. Wallace & Sons, of Ansonia, Conn., under orders from this bureau; and, if so, whether in your opinion the apparatus is suitable for signaling purposes on board ship.

Very respectfully, your obedient servant,

DANL. AMMEN,
Chief of Bureau.

Capt. K. R. BREESE, U. S. N.,
In charge of United States Torpedo Station, Newport, R. I.

UNITED STATES TORPEDO STATION,
Newport, R. I., June 8, 1877.

SIR: In reply to the bureau's letter of the 5th instant, relative to experiments with a magneto-electric light machine which was sent to this station by Messrs. Wallace & Sons, of Ansonia, I have to state that the machine referred to has been thoroughly tested to determine amount of light given, number of revolutions, and required power.

The data concerning these trials are all in the hands of Professor Farmer for discussion and report, and, but for his illness, would long since have been sent in.

The machine was found fully capable of furnishing an electric light for signaling or illuminating purposes, but, owing to its method of coupling up, required nearly one-half more power to produce the same light as a machine "coupled up" as directed by Professor Farmer, all other things being equal.

The automatic lamp which came with the machine works fairly well. It does not preserve a perfectly uniform length of arc (between the carbons), but near enough for practical purposes. There is no screen with the lamp for shutting off the light for signaling.

I desire to say that, in connection with this trial, comparisons are being made with the best machines and lamps of European manufacture, and a little more experiment under Professor Farmer on his restoration to health or return to the station will show the relative merits of each.

All these comparisons and trials have a direct bearing on signaling and lighting of ships.

Respectfully, your obedient servant,

K. R. BREESE,
Captain U. S. N., Inspector of Ordnance, in charge of Station.

Commodore DANIEL AMMEN, U. S. N.,
Chief Bureau of Navigation, Washington, D. C.

D.

UNITED STATES TORPEDO STATION,
Newport, R. I., October 24, 1877.

SIR: In obedience to your order, we have carefully tested the magneto-electric machine and electric lamp sent here by Wallace & Sons, of Ansonia, Conn., for the purpose of ascertaining their suitability for signal purposes, and beg leave to report as follows:

Driving the machine with 5.3 horse-power, we got 770 revolutions of the armature per minute, 2,439 candles as a momentary maximum light, the amount averaging about 700 candles, and about 1,300 volt-webers acting in the circuit.

A number of experiments indicated the efficiency of the machine—that is, the portion of the power which is converted into electricity—to be from 40 to 50 per cent.

Five hundred and ninety-eight candle-lights per horse-power applied have been obtained, but the average was much less than this—about 130.

The light-producing power of the machine in function of the power applied and weight of wire employed in the machine is between 3 and 4 candles per horse-power per pound of wire.

The efficiency of the machine in function of the velocity at which the machine is driven was not determined, owing to want of sufficient range of velocities to determine this relation.

We consider the most suitable velocity at which to drive the machine to be from 800 to 1,000 revolutions per minute.

We notice a peculiar method of dividing the coils on each core of the armature into four coils. The object, which is to lessen the extra current, does not compensate for the loss in power which accompanies this arrangement. The armature is cut away in such a way as to weaken it materially and render it liable to rupture when driven at a high speed; otherwise, the machine is compact and strong. It is our opinion that the resistance of the field of force should form a less portion of the whole resistance of the machine; by connecting the field of force-coils so as to make the resistance '4, its efficiency is improved, although that arrangement undoubtedly made the field resistance too small. Probably a better result could be reached by using coarser wire on the field-coils.

The lamp is vey simple in its construction, but has so short a feed that the light can only be shown about one hour continuously, and, from its peculiar construction, the force holding the carbons apart becomes so weakened as the carbons are burned away that the light flickers badly after burning a short time. This, not noticeable while the carbons are long, has been constantly seen during the last ten days, when the lamp has been burned about one hour each day. This flickering affects materially the value of the lamp for signaling or illuminating purposes.

We consider that both lamp and machine are suitable for use on board ship, but that both might be considerably improved—the machine to use less power to drive it, and the lamp to have longer feed and produce a more constant arc.

Very respectfully,

MOSES G. FARMER,
Electrician.
A. R. COUDEN,
Lieutenant and Assistant Inspector of Ordnance.

Capt. K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Station.

E.

UNITED STATES TORPEDO STATION,
Newport, R. I., October 29, 1877.

SIR: In accordance with your instructions contained in your letter of January 17, 1877, we have carefully tested the magento-electric machine and the electric lamp sent here by Messrs. Wallace & Sons, of Ansonia, Conn., and beg leave to report as follows:

The average of 19 experiments gave 6.3 as the horse-power required to maintain a velocity of 825 revolutions per minute, giving a strength of current of 13 to 15 webers and an electro-motive force of about 131 volts, with an external solid resistance of about 4.5 ohms and an internal resistance of 4.85 ohms, which gives 1,834 volt-webers acting in the circuit.

When used to produce light, about 5.3 horse-power gave 2,439 candles (Wallace carbons being used) as a momentary maximum, 770 revolutions per minute, a current of 13 webers, an electro-motive force of about 131 volts, an arc of about $\frac{3}{16}$ inch, polarization or opposing electro-motive about 31 volts, resistance of arc about 2.5 ohms, total resistance in circuit about 7.5 ohms, 1,300 volt-vebers acting in the circuit.

On one occasion ran machine and lamp for one-half hour. The lamp stopped feeding after 18 minutes; after starting again it ran well remainder of half hour. The light given out varied from 300 to 2,700 candles, using Wallace carbons. The speed of the machine varied from 710 to 795 revolutions per minute; the horse-power consumed from 6.48 to 7.28. The carbons gave off considerable flame, which, traveling around the arc, caused the light to vary as it did. About half the time the light given off exceeded 650 candles, and about half the time it was less than 650 candles.

Experiments were made to determine the light-giving power of different carbons with this machine. In the following table of the results obtained, the first column gives the names of the persons or firms from whom the carbons were received; where not otherwise stated, the carbons are made-up carbons.

Carbons.	Revolutions per minute.	Horse-power used.	Candle-light.	Candles per horse-power.	Remarks.
Wallace	800	4.38	2,619	598	During all except the last trial, the field of force-coils of the machine were connected in multiple arc.
Redding	848	4.34	1,211	279	
Redding sawn	845	3.47	402	116	
Siemens	872	3.38	935	276	In last case these coils were connected in series.
Wilde	836	4.05	935	231	
Do	770	5.33	841	158	

The last two experiments above would appear to show that 46% more light per horse-power was obtained with the field-coils connected in multiple arc than in the field-coils in series.

A repetition of this experiment gave the following results, the columns having same arrangement as in table above:

Wallace	732	4.05	729	162.	Field of force in series.
Redding	727	4.07	361	88.4	
Redding sawn	790	4.53	876	193.3	
Siemens	780	4.7	576	122.5	
Wilde	768	4.81	233	48.4	
Do	853	4.04	211	52.	Field of force in multiple arc.
Siemens	854	3.95	340	86.	
Redding sawn	847	2.88	435	156.5	
Wallace	875	2.95	435	147.	

These results differ materially from those given above. In these latter, the distance between candle and lamp was 70 feet, and in the other case the distance was 50 feet. The experiments were made in the evening, and the only illumination was from the electric light and the candle. The great discrepancy between these results indicates that a great number of experiments will be necessary to determine the best methods of coupling the coils. We are satisfied, however, that for the purpose for which the machine was intended it should have less resistance than as arranged when it came here, and that the field resistance should form a less proportion of the whole resistance.

The carbons furnished by Messrs. Wallace & Sons burn at the rate of about 4½ inches per hour. The extreme separation of the carbon holders in the Wallace lamp being but little greater than this, the light can only be shown continuously about one hour.

The amount of light produced by this machine is much inferior to that furnished by machines of same size and similar construction measured at the shops of Messrs. Wallace & Sons, at Ansonia, by Professor Farmer, the light in some cases amounting to 5,600 candles.

In order to determine the efficiency of the machine it is only necessary to reduce volt-webers to corresponding horse-power.

It can be readily shown, and is well known, that a volt-weber is 44.25 foot-pounds per minute, or is equal to .00134 of a horse-power. Hence to convert horse-power into volt-webers it is only necessary to multiply the former by 746; on the contrary, to convert volt-webers into horse-power, multiply by .00134.

To find the efficiency of the machine, therefore, you multiply the volt-webers the machine furnishes by .00134, and divide this product by the amount of horse-power consumed in driving the electrical machine.

Tested by this method we have found as the average of a number of experiments that the efficiency of this machine varies from 40 to 50 per cent.

We have found the maximum light per horse-power of the machine to be about 598 candles; this divided by 175, the number of pounds of wire in the machine, gives 3.41 as the number of candles per horse-power per pound of wire.

We have not thus far been able to get a sufficient range of velocities of the machine to enable us to determine satisfactorily its efficiency in function of the velocity.

Our experiments thus far indicate that when the resistance of the leading wires is very small (a small fraction of an ohm), a velocity of 800 to 900 revolutions per minute is as much as is desirable; when, from any reason, a resistance of 2 or 3 ohms is necessary in the leading wires, a velocity of 1,100 to 1,200 revolutions per minute will give better results. The construction of the armature of this particular machine is such, owing to a groove in the central plate, that we do not deem it safe to greatly exceed this latter velocity.

The machine consists of four electro-magnets, forming the field of force, held between two cast-iron upright-pieces, and a shaft having bearings in the upright-pieces which carries the armature-wheel. The whole stands on a bed-plate, to which the upright-pieces are bolted; the upright-pieces are further secured by a bolt which connects them at the top. The machine and bed are 23 inches high, 34½ inches long, and 13 inches wide. Four legs are supplied with the machine, which, bolted to the bed-plate, raise the machine 18 inches. The legs have a spread at the base of 25½ inches. On board ship the legs would not probably be used, as occupying additional and unnecessary space. The shaft has bearings 5½ inches long at each end, and carries two driving-pulleys, each 4 inches wide and 6 inches diameter. The cores of the electro-magnets are cast in one with the upright-pieces, two on each upright-piece. When in position, these cores face toward each other, and are situated one on each side above and one on each side below the shaft, and all four in the same vertical plane with the shaft. These cores are in section a segment of a circle whose center is at the center of the shaft, with the angle formed by the chord and circumference rounded off. The cores have a length of 7⅞ inches, and a section 5¾ inches horizontally, by 1¾ inches vertically. The ends are faced with brass about one-eighth-inch thick.

The field-of-force coils are wound on brass spools shaped to fit the cores, the coils 7⅝ inches long and 1⅜ inches thick. They are wound with copper wire 0″.128 diameter, have 48 convolutions in each layer, and 8 layers, making 364 convolutions.

The wire is insulated with closely braided cotton, and before winding the coil the wire with its braiding has been dipped into shellac. The resistance of each coil is .601 ohm at 70° Fahrenheit.

The armatures are two in number, each separate and distinct. The armature-wheel of cast iron is 13 inches in diameter, and has cast on each face twenty-five cores for the armature-coils. A deep score is cut into the armature-wheel between the sets of cores, probably with a view of lessening weight of wheel. The armature-cores are, in section, portions of sectors of a circle, having same center as armature-wheel, and with a radius about a quarter of an inch less than that of armature-wheel. The radial length of each core is about 2 inches, the circumferential length about three-quarters of an inch. The corners are rounded off. The length of these cores is about two and three-quarter inches.

On each of these cores fits a brass bobbin, on each bobbin are four coils of insulated copper wire, .047 inch diameter, each coil extending the whole length of the core. The coils are 2⅝ inches long and ⅝ inch thick, each has 45 convolutions in each layer, and 2 layers, making 360 convolutions on each core. The wire in these coils is insulated with cotton wrapping and the whole dipped in shellac after winding. All the coils on each side of the armature-wheel are connected to a commutator having 100 divisions, thus forming two complete armatures. The commutator-pieces are insulated by air-spaces, the ends resting in box-wood hubs. The resistance of each armature is 4.89 ohms at 70° Fahrenheit.

The commutator-brushes, two for each commutator, are made of small copper wires bound together and soldered.

The field-of-force coils are so connected up that the upper coil on one side of armature-wheel presents the same pole toward the armature as the lower coil on the other side, the other two of the four field-of-force coils presenting each a pole of the opposite name. The diameter of the armature-wheel is such that when revolved the cores of each armature are presented in succession directly opposite the cores of their field-of-force coils. The distance between the faces of the armature-cores and field-of-force cores is about one-eighth of an inch.

The machine is connected with the field-of-force coils in series and armatures in multiple arc. The connections may be readily changed if desirable at any time.

The entire machine weighs 918 pounds, of which the legs form 118 pounds; other cast-iron parts, 576 pounds; copper in field of force, 138 pounds; copper in armature, 45 pounds; brass spools, about 20 pounds, and steel shaft about 21 pounds.

The automatic lamp furnished by Messrs. Wallace & Sons is very simple in its construction and action. The carbon points are made to approach each other by the greater weight of the upper carbon-holder, and, when the two carbons are in contact, are made to separate and afterward maintain the requisite distance by the attraction of two axial magnets on their cores or armatures.

The upper carbon-holder has a long bearing, and is suspended by two thin metal bands, secured to the circumferences of two metal wheels of equal diameter, situated on opposite sides of the carbon-holder. On the same axles are two similar wheels of half the diameter of the others. From these latter are similarly suspended, by thin metal bands or strips, the two axial magnet cores or armatures. A cross-head, which has fixed to it the lower carbon-holder, connects the two armatures or cores. By this arrangement the upper carbon travels at twice the rate of the lower carbon, and when the upper is connected to the positive pole of the source of electricity the light maintains a constant position.

The magnet-coils are in the light circuit, and the action of the lamp is as follows: The carbons being in contact, when the current is turned on the armatures are attracted downward, carrying with the lower carbon-holder, and by means of the metal suspending-bands producing a partial revolution of the large and small wheels. This movement causes the upper carbon to move upward twice the distance that the lower carbon has moved downward. By this means the arc is established, the establishment of which increases the resistance of the circuit and decreases the strength of current, until the attractive force, acting on the armatures, is just balanced by weight of the upper carbon-holder. An adjustable friction-brake on the upper carbon-holder prevents the carbons from being moved through more than a certain distance. This distance may be readily adjusted.

As the carbons become shorter, the armatures rise and occupy a different position in reference to their coils, and the same current passing through the coils has less force on the armatures. This loss of power is partly compensated by the more rapid burning away of the upper carbon. To maintain a tolerably constant length of arc during the entire length of the carbons, extra weights are provided with the lantern which may be slipped on the upper carbon-holder when the carbons are long, and taken off as the carbons burn away. Very recent trials, continued for several successive days, indicate that this lack of constancy in the light materially affects its value for signaling or illuminating. The length of carbon which may be burned in this lamp without renewal is only about 6 inches, or about 1¼ hours' light. This is a fault; other lamps burn more than twice this length. The withdrawal of the armatures from the coils is probably the cause of this short allowance. No special conveniences of any sort were furnished with this lamp for signaling purposes.

The machine in its general features is built in accordance with suggestions furnished by Professor Farmer, some few details of construction having been varied by Messrs. Wallace & Sons in order to give the machine greater durability. We notice particularly one fault in the construction of the armature, viz, a deep groove cut in the middle of the armature-plate. The object of this groove was apparently to lessen the amount of iron to be magnetized and demagnetized, but the slight advantage gained is not worth the risk of fracture which is thereby engendered when the armature is in rapid rotation.

We notice as another objectionable feature that each armature-core is supplied with four independent coils, which are connected to successive divisions of the commutator. There being twenty-five cores on each side of the armature, and four coils to each core, there are one hundred divisions in each commutator. The object of this subdivision of the coils and commutators is to reduce the spark arising from the extra current. Although the method adopted of winding the wire on the helices, and of dividing or breaking it up into several smaller helices, does considerably decrease the extra current, it at the same time decreases the capacity or power in about the same ratio.

It is believed by us that this object might be better attained by having the armature-cores smaller, more numerous, and by having those on one side of the armature-wheel placed opposite the spaces on the other side of the wheel, each core to have but one coil, all the coils on both sides of the armature to be connected into one unbroken series, and all connected to one commutator. By having thirty or more coils on each side of the armature, instead of twenty-five, as now, and setting the cores staggering or alternating, as described above, like one built by Professor Farmer some years since, the commutator would have sixty or more divisions, the spark from the extra current would be little, if any, greater than now, and the energy evolved by the machine would be greater.

We find by comparisons made with a machine tried here, having only seventy-five commutator-divisions, built by the same firm for Professor Farmer, that the energy of the latter is considerably greater than that developed by this machine under similar circumstances.

Very respectfully,

MOSES G. FARMER,
Electrician.
A. R. COUDEN,
Lieutenant and Assistant Inspector of Ordnance.

Captain K. R. BREESE, U. S. N.,
Inspector of Ordnance, in charge of Station.

No. 7.—BUREAU OF MEDICINE AND SURGERY.

NAVY DEPARTMENT,
BUREAU OF MEDICINE AND SURGERY,
October 18, 1877.

SIR: Agreeably to your order of the 10th instant, I have the honor to submit the annual report of this bureau, with estimates of deficiencies for the past and current years, and for the support of the medical establishment of the Navy for the fiscal year ending June 30, 1879.

The various squadrons and naval stations have been supplied during the past year with everything requisite for the treatment and comfort of the sick. The health of the Navy has been good. No pestilential or epidemic disease has prevailed, and the mortality has been less than the usual average.

During the past summer the customary visit of inspection was made to most of the principal hospitals of the Navy; and also, for the purpose of comparison, to some of the civil hospitals of the country. The management of the naval hospitals was found to be satisfactory, the officers in charge having done all that was possible with the means at their disposal; but all these establishments presented evidence, more or less, of the parsimony which has of late years been a necessity, in consequence of insufficient appropriations. While the sick have not been deprived of anything indispensable to their proper treatment or comfort, the furniture, the buildings, and the ground surrounding them convey the impression that they are not maintained with the liberality which should characterize establishments belonging to the nation. In these respects they do not compare favorably with many State and municipal institutions of similar character, or even with some of those which are supported solely by the benevolence of private individuals.

The hospitals at Chelsea, Brooklyn, Philadelphia, Washington, and Annapolis require repainting and other repairs made necessary by wear and tear and the action of the elements. The hospital at Norfolk, one of the largest and most substantial, requires very extensive repairs and improvements. The sewerage is defective, the supply of water bad, and the mode of heating, by stoves, is objectionable on account of health, comfort, convenience, economy, and danger from fire. The cost of removing these defects is included in the estimates.

The hospital at Mare Island now receives a large number of patients from the Pacific and Asiatic squadrons. The quarters in the building now necessarily occupied by the medical officer in charge are needed for the accommodation of the sick. An estimate for a house to be built on the hospital grounds for that officer is submitted.

The hospital, or sick quarters, at the navy-yard, Portsmouth, N. H., is an old frame building, originally a farm-house. It is incommodious, badly ventilated, falling into decay from age, and in every respect unfit for use as a hospital. The quarantine hospital, a wooden structure not much better than a shed, is also rapidly decaying, and is liable to be blown down or washed away in a storm. Situated on a small rocky islet at the mouth of the harbor, and thus exposed to the fury of the elements, access to it would be difficult, perhaps impossible, in stormy weather. For these reasons it should be removed or abandoned, as the cost of removal would probably exceed the value of the material.

A very appropriate and beautiful site for a hospital exists on Seavy's Island, belonging to the navy-yard, sufficiently distant from the latter and from the neighboring town to avoid danger of communicating any pestilential disease. On that site a building of moderate dimensions and cost might be erected which would answer all the purposes of the two existing structures.

The proximity of a group of small Japanese dwellings to the naval hospital at Yokohama exposes that building to danger in case of fire, an event which is very probable from their inflammable material and the general use of coal-oil for illumination. The commanding officer and surgeon of the fleet of the Asiatic squadron recommend that the ground on which these houses stand be purchased and added to the hospital grounds. The purchase can be made for the sum of $600.

In 1876, the Secretary of the Navy directed the hospital at Annapolis to be closed, which was accordingly done. In April and May of the present year, an outbreak of measles took place in the town and extended to the Academy, affecting a small number of the cadets. The Superintendent of the Academy very judiciously ordered the hospital to be temporarily reopened for the reception of these cases, thereby preventing, in all probability, the further extension of the disease. The usefulness of the hospital on that occasion is a proof that it would be valuable in similar emergencies.

To most of the naval hospitals outbuildings are attached, intended for the reception of patients affected with smallpox. They are seldom used, and are very much out of repair. As cases of small-pox in the Navy are not numerous, it would be more economical for the government to send such cases to the local hospitals provided for that disease by the civil authorities.

NAVAL HOSPITAL FUND.

Since 1861, the hospital establishment of the Navy has been increased by the addition of the hospitals at Philadelphia, Annapolis, Washington, Mare Island, and Yokohama, Japan. Consequently the expenses have been nearly doubled, while at the same time the hospital fund from which these expenses are paid has diminished in a still larger proportion.

This decrease is due partly to large expenditures in building and furnishing, and partly to the additional expense of supporting a greater number of hospitals. Something is also due to the high prices of provisions, &c., during the last ten years.

The expense of keeping these large establishments open is almost as great with a small as with a large number of patients. The number of attendants cannot be reduced below a certain number, necessary to keep them in proper order, while the cost of heating, lighting, and keeping them in repair is about the same, whatever be the number of inmates.

The hospital-fund, which, as you are aware, is derived from the deduction of twenty cents per month from the pay of the officers and men of the Navy and Marine Corps, and from the value of their rations when in hospital, amounted in 1868 to $436,592.59. That large amount was due to the accumulation of proceeds in the several years preceding, during which a very large number of men were employed in the naval service. Since that period it has rapidly diminished, as the following statement of the amounts to the credit of the fund at the beginning of each fiscal year will show:

July 1, 1868	$436,592 59
July 1, 1869	394,660 69
July 1, 1870	284,758 23
July 1, 1871	200,515 63
July 1, 1872	100,597 65
July 1, 1873	56,534 70
July 1, 1874	26,583 94
July 1, 1875	1,141 37
July 1, 1876	290 92
July 1, 1877	70 63

There is due to the fund from "Pay of the Navy" about $50,000; from the Marine Corps, about $30,000; and from "Surgeons' necessaries and appliances" $52,985.17.

If these amounts can be obtained, there will be sufficient to meet the expenses of the hospital establishment for the current year. Thereafter an annual appropriation of from ninety to one hundred thousand dollars will be required, inasmuch as after the sums above referred to have been received and disbursed, there will be nothing coming to the fund except the regular annual income, which amounts, with the present force of the Navy, to about thirty-seven thousand dollars; not much more than enough to support one of the larger hospitals. An estimate for the support of hospitals for the next fiscal year is therefore submitted.

SURGEONS' NECESSARIES AND APPLIANCES.

The appropriations for surgeons' necessaries and appliances for the last three years, having been very much reduced below the estimates, were not sufficient for the wants of the service. The deficiency was taken from the hospital-fund, to which there is now due from that source, as previously stated, the sum of $52,985.17.

The practice which has prevailed for many years of furnishing medicines from the public stores to the families of officers at the various naval stations, has of late years proved burdensome to the limited resources of the bureau. No law or regulation authorizes this expenditure, but it has been sanctioned by custom and by the tacit approval of the department. There is no means of accurately ascertaining the amount expended in this way, but it may be roughly estimated at about three or four thousand dollars per annum. In order to legalize this outlay, the sum of $3,000 is asked for in the estimate.

ASSISTANT SURGEONS.

The number of assistant surgeons allowed by law is now, for the first time since 1865, nearly complete, only four vacancies existing, which will probably be filled by the end of the year. In consequence of the difficulty of obtaining properly-qualified young men for the regular corps, authority was given by Congress to the Secretary of the Navy to appoint acting assistant surgeons for temporary service. The number of that class of officers is now twenty-two.

An order of the department requiring assistant surgeons to serve two years at sea before examination for promotion, has been of late years, on account of the small number of ships commissioned for sea-service, difficult of execution within the time, three years, at the end of which they are by law entitled to examination. The operation of the order referred to is found to do injustice to those who have been unable to meet its requirement; the failure to do so being not their fault but that of the department. The attempt to execute the order causes many otherwise unnecessary changes of station, and much useless cost to the government in the payment of traveling-expenses. The revocation or modification of this order is therefore desirable.

By the regulation of 1876, assistant surgeons of the relative rank of ensign are relegated to the steerage. These officers have enjoyed the privileges of the ward-room for a period of more than thirty years, and the same reasons which caused their admission to the ward-room still exist. This retrograde step appears to have been taken because it was deemed proper that officers of the same relative rank should live and mess together on board ship. The law of March 3, 1871, provides that "no staff-officer shall, in virtue of his relative rank or precedence, have any additional right to quarters." A fair inference from that proviso seems to be that while it conferred no additional rights, it recognized and confirmed those already existing.

Instruction in hygiene, chemical manipulation, and microscopy, a knowledge of which is now indispensable to the accomplished physician, is not given, or very imperfectly given, in most of the medical schools of the country. In some of the large cities special instruction in these branches is given, sometimes in connection with the colleges, but attendance by students is not obligatory or necessary to graduation; consequently, many of the young men who enter the service as assistant surgeons are not as well informed on these subjects as they should be. In view of this important deficiency in their education, it is recommended that assistant surgeons be ordered, some months previous to their examination for promotion, to the hospital at New York for instruction in these branches. New York is recommended because the naval laboratory on the hospital-grounds can afford facilities for chemical study not otherwise attainable without considerable expense. In addition to the facilities for study and observation offered by the naval hospital and laboratory, the large civil hospitals of the city would be within easy reach. A diligent attendance upon them for a few months would be equivalent to the experience of many years in the ordinary practice of the Navy.

APOTHECARIES.

A permanent corps of apothecaries for the Navy is very desirable. These useful officers are now appointed for the cruise by the surgeons of ships, and at hospitals and navy-yards by the chief medical officer, for an indefinite length of time. On account of the brief time for which the appointment is made, and the uncertainty of its tenure, as well as the inferior rank assigned to them, that of "petty officer," competent men of good character and habits are with difficulty obtained, and with still greater difficulty retained in the service. They should be appointed by warrant, or otherwise, by the Secretary of the Navy, after having been examined and approved by a board of medical officers. They should have a certain rank in the Navy, and be assigned to suitable quarters on board ship, instead of being, as now, compelled to live and mess on the berth-deck. The Navy is a very conservative body, attached to old customs and opposed to innovations, yet in this case, the obvious advantages to be derived from the change suggested will, it is hoped, overcome these obstacles.

The instruments and instructions for carrying out your order of May 21, 1877, directing hygrometric and eudiometric observations to be made on board the ships of the Navy in commission, have been prepared and are now being issued. Great benefit to the Navy will doubtless result from these observations. The sanitary arrangement of our ships of war, which has been, to a great extent, governed by the dissimilar mandates of commanding officers, will be hereafter established upon a scientific basis.

Sufficient matter has accumulated for the publication of another volume of Medical and Sanitary Reports of the Navy. The previous volume, published in 1875, containing the reports of 1873-'74, was received with much favor by the medical profession, and, it is believed, has been of great value to the Navy by diffusing among the officers some knowledge of sanitary science.

A report of surgical casualties in the Navy from 1860 to 1870 has been in preparation for several years under the supervision of a medical inspector of the Navy, and is now ready for publication. A joint resolution introduced in the House of Representatives (Forty-fourth Congress, second session), authorizing the Public Printer to print and bind five thousand copies of this work, failed to pass. As the report is a carefully-prepared summary of a vast amount of experience, a knowledge of which would be beneficial to the community, as well as to the medical profession, your influence in procuring the legislation necessary for its publication is solicited.

The bureau has in preparation a new book of "Instructions to Medical Officers," containing changes made necessary by orders issued by the department since the last issue in 1873, and embodying such improvements as time and experience have suggested. In a short time it will be submitted to you for approval.

An additional clerk is necessary in this bureau. The information required by the Commissioner of Pensions from this office would alone give him sufficient employment. With our present small clerical force, applicants for pension have the adjustment of their claims unavoidably delayed by our inability to furnish promptly the necessary evidence. An estimate for one additional clerk of class two is submitted in the estimates for the bureau.

The medical statistics of the Navy for the year ending December 31, 1876, and also a summary statement showing the death rate and comparative health of the various squadrons for the years 1865 to 1876, inclusive, are appended to this report.

I have the honor to be, very respectfully, your obedient servant,

W. GRIER,
Surgeon-General, United States Navy.

HON. RICHARD W. THOMPSON,
Secretary of the Navy.

A.—*Annual statement compiled from sick-reports from naval stations and vessels in commission on home and foreign service for the year ending December* 31, 1876.

	Average number on board in 1876.	Remaining sick December 31, 1875.	Admitted in 1876.	Discharged in 1876.	Died in 1876.	Total treated in 1876.	Remaining sick December 31, 1876.	Percentage of deaths to number treated.
HOSPITALS.								
Chelsea	....	6	53	36	8	59	15	....
Brooklyn	....	43	202	208	4	245	33	....
Philadelphia	....	35	145	139	21	180	20	....
Annapolis	....	4	17	20	1	21	....	....
Washington	....	19	58	62	6	77	9	....
Norfolk	....	27	236	229	8	263	26	....
Pensacola	....	2	25	24	1	27	2	....
Mare Island	....	43	114	99	15	157	43	....
Yokohama, Japan	....	15	68	75	1	83	7	....
Total	....	194	918	892	65	1,112	155	0.05
NAVY-YARDS AND STATIONS.								
Portsmouth, N. H	....	6	90	91	2	96	3	....
Boston	....	....	123	118	1	123	4	....
Brooklyn	....	7	239	233	1	246	12	....
Philadelphia	....	2	80	81	....	82	1	....
League Island	....	2	....	2	....	2	....	....
Washington	....	1	239	237	....	240	3	....
Norfolk	....	1	164	161	1	165	3	....
Pensacola	....	1	60	59	....	61	2	....
Mare Island	....	3	42	43	....	45	2	....
Torpedo Station	....	1	44	42	1	45	2	....
Naval Academy	....	23	847	857	2	870	11	....
Marine Barracks, New York	....	7	239	233	1	246	12	....
Marine Barracks, Washington	....	....	195	195	....	195	....	....
Total	....	54	2,362	2,352	9	2,416	55	0.004
RECEIVING-SHIPS.								
Portsmouth, N. H	163	2	157	158	1	159	....	....
Boston	235	7	110	115	....	117	2	....
Brooklyn	383	3	99	99	....	102	3	....
Philadelphia	102	3	77	80	....	80	....	....
Norfolk	170	1	88	89	....	89	....	....
Mare Island	111	4	63	67	....	67	....	....
Total	1,169	20	594	608	1	614	5	0.001

SUMMARY OF VESSELS IN COMMISSION.

Average number of persons on board during year 1876	11, 138
Remaining sick December 31, 1875	222
Admitted in 1876	7, 575
Discharged in 1876	7, 605
Died in 1876	41
Total treated in 1876	7, 797
Remaining sick December 31, 1876	151
Percentage of cases to number on board	0. 70
Percentage of deaths to number on board	0. 003
Percentage of deaths to number of cases treated	0. 005

RECAPITULATION.

	Aggregate number of officers and men on board in 1876.	Remaining sick December 31, 1875.	Admitted in 1876.	Discharged in 1876.	Died in 1876.	Total treated in 1876.	Remaining sick December 31, 1876.	Percentage of cases to number of persons on board.	Percentage of deaths to number of persons on board.	Percentage of deaths to number of persons treated.
Naval hospitals	....	194	918	892	65	1, 112	155	....	....	0. 05
Yards and stations	....	54	2, 362	2, 352	9	2, 416	55	....	....	0. 004
Receiving-ships	1, 169	20	594	608	1	614	5	0. 50	0. 001	0. 001
Vessels in commission at sea	11, 138	222	7, 575	7, 605	41	7, 797	151	0. 70	0. 003	0. 005
Total	12, 307	490	11, 449	11, 457	116	11, 939	366	0. 90	0. 009	0. 009

At the close of the year 1875 there remained under treatment 490 cases; during the year 1876 there occurred 11,449 cases of disease, injury, &c., making a total of 11,939 cases treated during the year; of which number 116 died, 11,457 were returned to duty or discharged the service, leaving 366 cases under treatment at the close of the year 1876.

The average strength of the Navy (officers, seamen, marines, engineer service, and coast survey included) for the year 1876, as near as can be ascertained, was about 12,307.

The percentage of cases admitted to the whole number of persons in the service was about 0.90, or each person was on the sick-list $\frac{90}{100}$ times during the year. The percentage of deaths to the whole number of persons in the service was 0.009, and the percentage of deaths to number of cases treated was 0.009.

The total number of deaths from all causes, reported to the Navy Department, from October 1, 1876, to October 1, 1877, was 101.

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1876.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		School and practice.		Coast-survey.		Total.	
Aggregate number of men	5, 920.		430.		1, 238.		1, 693.		1, 304.		301.		742.		110.		11, 138.	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class I.—Zymotic diseases:																		
Order I.—Miasmatic diseases:																		
Catarrhus epidemicus	5				35				3						12		55	
Cholera epidemica																	1	
Cynanche parotidea									1									
Dengnis																		
Diphtheria	1																1	
Erysipelas	8		2		1		5		10				1		1		28	
Febris cerebro-spinalis					5												5	
Febris continua simplex	58		15		10		11		6		1		1				102	
Febris enterica	7		1		1						1		2	1			12	1
Febris flava																		
Febris intermittens	195		11		49		75		86		20		11		6		453	
Febris recidiva	1				1												2	
Febris remittens	38				7		18		7		4				2		76	
Febris typhus	4																4	
Morbilli	1						1										2	
Pertussis																		
Pestis																		
Phagedæna putris									3								3	
Pyæmia																		
Scarlatina	2																2	
Varicella	1																1	
Variola	2								3	1							5	1
Varioloides																		
Vaccinia					1												1	
Order II.—Enthetic diseases:																		
Syphilis primitiva	93		19		40		41		65		2		2		9		271	
Syphilis consecutiva	53		15		10		19		49		1		4		2		153	
Gonorrhœa	65		19		12		62		70		4		12		6		250	
Opthalmia gonorrhöica																		
Bubo	7								5								12	
Chancroid	1		3						9								13	

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1876—Continued.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		School and practice.		Coast-survey.		Total.	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class I.—Zymotic diseases—Continued.																		
Order III.—Dietic diseases:																		
Alcoholismus	39		1		5		39		18	1	5		1		2		110	1
Delirium tremens	6		2				2		1								11	
Ebriositas	1								29				1				31	
Fames																		
Scorbutus					1												1	
Class II.—Constitutional diseases:																		
Order I.—Diathetic diseases:																		
Adynamia	80				29		8		23				20				160	
Anæmia	4								1		1						6	
Carcinoma									1								1	
Gangræna senilis	1																1	
Hydrops	1				2												3	
Podagra	5				1												6	
Rheumatismus acutus	109		5		23		42		84		8		1		4		276	
Rheumatismus chronicus	122		8		20		48		47		2		1		2		250	
Order II.—Developmental diseases:																		
Atrophia	1																1	
Degeneratio																		
Hypertrophia									1								1	
Senectus	2						2										4	
Order III.—Tubercular diseases:																		
Scrofula	2						1		1								4	
Tuberculosis	3																3	
Class III.—Parasitic diseases:																		
Scabies	1								2								3	
Vermes	2		1								1						4	
Tænia lata	1																1	
Class IV.—Local diseases:																		
Order I.—Diseases of the nervous system:																		
Apoplexia	8	2					1										9	2
Cephalalgia	37				3		6		19		2		3		1		71	
Cerebritis	1																1	
Chorea	1																1	
Dementia	9		1		1		2		3								16	

Epilepsia	16		1		3		6		8								34	
Insolatio	5						1		1				1				8	
Irritatio spinalis							1				1						2	
Mania	3								1				1				5	
Melancholia	2						3		1		3						9	
Meningitis	1						1										2	
Myelitis																		
Neuralgia	71		3		12		44		27		6		5				168	
Nostalgia																		
Paralysis	2		1		2				1				1				7	
Vertigo	6						1		1		1						9	
Congestion of the brain	2								1								3	
Pleurodynia	2																2	
Exhaustion									1								1	
Order II.—Diseases of the eye:																		
Amaurosis	4		1						1								6	
Cataracta	1																1	
Conjunctivitis	38		1		11		5		8		3		3		2		71	
Fistula lachrymalis	1												2				3	
Hemeralopia					4												4	
Iritis	4		7	1					1								12	1
Nyctalopia																		
Ophthalmia	7				2				4								13	
Pterygium	1																1	
Retinitis	1				1		1										3	
Ulcus cornea	1																1	
Hordeolum	1																1	
Corneitis	1																1	
Order III.—Diseases of the ear:																		
Otalgia	2												1				3	
Otitis	7				1				6								14	
Otorrhœa	4				2				1				1				8	
Surditas	7						1		1								9	
Order IV.—Diseases of the teeth:																		
Odontalgia	3								2		1				2		8	
Order V.—Diseases of the circulatory system:																		
Aneurysma					1	1			1								2	1
Angina pectoris	1								1						1		3	
Endocarditis																		
Hydrops pericardii																		
Hypertrophia cordis	1																1	
Morbi valvularum cordis	5		2	1	2		3		6		1						19	1
Palpitatio	28				7		8		9								52	
Pericarditis	1						2		5								8	
Phlebitis	2																2	
Varix	6								1								7	
Hæmoptysis	1																1	
Dilatatio cordis	2																2	
Order VI.—Diseases of the respiratory system:																		
Apnœa	1																1	
Asthma	23		1		1		3		3								31	
Bronchitis acuta	95	1	5		19		42		39		18		1		2		221	1

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1876—Continued.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		School and practice.		Coast-survey.		Total.	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class IV.—Local diseases—Continued.																		
Order VI.—Diseases of the respiratory system:																		
Bronchitis chronica	25		2		3		13		14		2		1				60	
Catarrhus	147		6		39		68		35		16		40				351	
Epistaxis	1														1		2	
Hydrothorax																		
Laryngitis	7				4		2				6				5		24	
Phthisis pneumonica acuta	5						1	1			1						7	1
Phthisis pneumonica chronica	13		1		5	2	7		3		2						31	2
Pleuritis	21		1		3	1	8		4		4						41	1
Pneumonia	23	2	1				2		4	1	2	2			2		34	5
Emphysema	2																2	
Congestion of lungs	1																1	
Hæmoptysis					1				3		1						5	
Order VII.—Diseases of the digestive system:																		
Ascites			1	1													1	1
Cholera morbus	28		4		38		16		21		2		5		1		115	
Cirrhosis hepatis																		
Colica	36		2		2		11		30		5		2		2		90	
Constipatio	19				6		5		5		4		1		8		48	
Diarrhœa acuta	146		7		52	1	60		192	1	16		29		9		511	2
Diarrhœa chronica	15						2	1	13	3	1						31	4
Dysenteria acuta	36		12		16		3		35		11		2		5		120	
Dysenteria chronica	8				2		3		1								14	
Dyspepsia	18		1		4		10		31		3				1		68	
Enteritis	1		1		1				1								4	
Fistula in ano	7		1		2		3		2								15	
Gastritis	3								1		1						5	
Hæmatemesis					6		4		1								11	
Hæmorrhois	26		6		1		1		10		3						47	
Hepatitis acuta	3								1								4	
Hepatitis chronica	3		1				2										6	
Icterus	6		1		2		5	1	3		2						19	1
Peritonitis							1										1	
Pharyngitis	8		1		3		2				9						23	
Prolapsus ani							1										1	

Splenitis	2																2	
Stomatitis	2																2	
Tonsillitis	81		7		16		27		34		12		5		2		184	
Parotitis	3		1														4	
Pyrosis									1								1	
Order VIII.—Diseases of the urinary and genital system:																		
Albuminuria					1	1	1										2	1
Calculus									2								2	
Cystitis	2		1		1		7		2								13	
Diabetes			1														1	
Dysuria	2						1		3								6	
Ischuria	1																1	
Nephritis	1								1		1						3	
Orchitis	43		2		14		9		42		1		1		3		115	
Paraphymosis							2										2	
Phymosis	3				3		2										8	
Enuresis	2								2								4	
Fistula vesicæ	1																1	
Hæmaturia	2																2	
Hydrocele	2						1		2								5	
Spermatorrhœa	3						1								1		5	
Urethræ strictura	20		4		2		3		10								39	
Varicocele	6																6	
Epididymitis	1								2								3	
Order IX.—Diseases of the locomotive system:																		
Arthritis	6						2										8	
Ankylosis	2				1				1								4	
Caries									2		1						3	
Coxalgia																		
Hydrops articulorum	2																2	
Necrosis	2								2		1						5	
Ostitis	1																1	
Periostitis	7				2				1		2						12	
Synovitis	3				2		1		5								11	
Myositis	1																1	
Order X.—Diseases of the integumentary system:																		
Abscessus	104		4		49	1	26		54		9		12		5		263	1
Acne	3						3										6	
Adenitas	57		7		16		21		23				3				127	
Anthrax	5		4		2				5								16	
Ecthyma	1				3		3										7	
Eczema	7		4		2		6		6								25	
Erythema	3								3								6	
Furunculus	127		18		56		50		61		7		14		3		336	
Herpes			1		1		1										3	
Impetigo																		
Lepra																		
Lichen	1																1	
Paronychia	21		20		6		10		13								70	
Pemphigus																		
Pernio	2				9				2		1						14	

Summary of prevalent forms of disease on home and foreign service for the year ending December 31, 1876—Continued.

	North Atlantic.		South Atlantic.		European.		Pacific.		Asiatic.		Special service.		School and practice.		Coast-survey.		Total.	
	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.	Cases treated.	Deaths.
Class IV.—Local diseases—Continued.																		
Order X.—Diseases of the integumentary system:																		
Porrigo	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....	2	.....
Prurigo	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	1
Psoriasis	1	.....	.....	.....	.....	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	3	.....
Rupia	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....
Unguis involutis	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Ulcus	10	.....	.....	.....	1	.....	1	.....	12	.....	.....	.....	1	.....	.....	.....	25	.....
Cellulitis	3	.....	.....	.....	.....	.....	1	.....	.....	.....	2	.....	.....	.....	.....	.....	6	.....
Onychia	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Class V.—Non-malignant tumors and cysts:																		
Adenoma	2	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	3	.....
Angeioma	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cystis sebacea	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2	.....
Enchondroma	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Fibroma	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lipoma	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Neuroma	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Osteoma	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Polypus	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sarcoma	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Epithelioma	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Class VI.—Violent diseases and deaths:																		
Order I.—Wounds, injuries, and accidents:																		
Abrasio	33	.....	5	.....	15	.....	24	.....	9	.....	1	.....	2	.....	1	.....	90	.....
Ambustio	43	.....	3	.....	15	.....	3	.....	16	.....	.....	.....	1	.....	1	.....	82	.....
Concussio cerebri	2	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	2	1	.....	.....	5	1
Contusio	175	.....	21	.....	86	.....	75	.....	108	.....	15	.....	8	.....	4	.....	492	.....
Explosio	2	.....	.....	.....	4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	.....
Fractura	25	2	.....	.....	5	.....	9	.....	5	.....	.....	.....	.....	.....	.....	.....	44	2
Hernia	30	.....	1	.....	5	.....	3	.....	2	.....	.....	.....	2	.....	.....	.....	43	.....
Luxatio	17	.....	1	.....	2	.....	6	.....	3	.....	2	.....	.....	.....	1	.....	32	.....
Stremma	92	.....	16	.....	29	.....	30	.....	28	.....	9	.....	12	.....	1	.....	217	.....
Submersio	2	2	.....	.....	.....	.....	2	2	1	1	3	2	.....	.....	.....	.....	8	7
Venenatio	3	1	.....	.....	.....	.....	.....	.....	1	.....	4	.....	.....	.....	.....	.....	8	1

Vulnus contusum	81	......	8	......	13	......	27	......	39	......	9	......	27	......	1	......	205	......
Vulnus incisum	69	......	5	......	24	......	23	......	17	......	......	......	5	......	......	......	143	......
Vulnus laceratum	37	1	2	......	14	......	14	1	9	......	2	......	2	......	1	......	81	2
Vulnus punctum	31	......	3	......	9	......	14	......	12	......	......	......	3	......	......	......	72	......
Vulnus sclopetarium	4	......	......	......	1	......	......	......	2	......	......	......	......	......	......	......	7	......
Vulnus venenatum	2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	2	......
Concussio spinalis	2	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	2	......
Total	3, 151	11	313	3	924	7	1, 144	6	1, 636	8	259	4	256	2	114	......	7, 797	41

Medical statistics of the United States Navy for the years 1865 *to* 1876, *inclusive.*

Year.	Aggregate number of men.	Cases treated.	Deaths.	Sick-rate per M.	Death-rate per M of sick.	Highest sick-rate per M and stations.	Highest death-rate per M and stations.	Lowest sick-rate per M and stations.	Lowest death rate per M and stations.
1865	29, 400	38, 076	480	1, 265 +	12 +	2,538 + Iron-clads	34 + West Indies	927 + European	0 Coast Survey.
1866	15, 108	15, 121	179	1, 053 +	11 +	1,662 + Asiatic	17 + European	654 + Coast Survey	3 + School and practice.
1867	10, 862	12, 231	206	1, 127 +	16 +	1,575 + Asiatic	115 + Coast Survey	590 + Coast Survey	0 School and practice.
1868	13, 310	10, 456	106	785 +	10 +	1, 111 + Asiatic	13 + Special service	274 + Special service	0 Coast Survey.
1869	12, 201	8, 325	64	682 +	7 +	1,653 + Coast Survey	11 + South Atlantic and Pacific	425 + School and practice	0 Coast Survey.
1870	10, 760	8, 904	52	827 +	5 +	1,331 + South Atlantic	12 + Special service	357 + School and practice	0 Coast Survey.
1871	10, 763	10, 118	81	940 +	8 +	1,258 + North Atlantic	13 + Asiatic	393 + Special service	0 Coast Survey.
1872	11, 570	9, 207	61	795 +	6 +	2,040 + Coast Survey	10 + North Atlantic	707 + Special service	0 School and practice.
1873	12, 723	8, 828	55	694 +	6 +	930 + South Atlantic	11 + European	416 School and practice	0 School and practice.
1874	13, 870	9, 995	64	720 +	6 +	1,125 + Coast Survey	11 + European	470 School and practice	0 School and practice.
1875	10, 141	7, 832	49	772 +	6 +	1,191 + Coast Survey	20 + South Atlantic	587 + Special service	3 + North Atlantic.
1876	11, 138	7, 797	41	700 +	5 +	1,254 + Asiatic	16 + Special service	345 + School and practice	0 Coast Survey.

Of the classes of the four most frequently recurring diseases the following have the death-rate per thousand.

Year.	Classes.			
	Diseases of the circulatory system.	Diseases of the respiratory system.	Febrile diseases.	Diseases of the digestive system.
1865	17+	22+	15+	6+
1866	46+	21+	19+	11+
1867	47+	23+	46+	6+
1868	38+	33+	24+	4+
1869	28+	21+	16+	4+
1870	20+	11+	8+	3+
1871	31+	17+	8+	5+
1872	36+	17+	10+	6+
1873	50+	11+	9+	4+
1874	61+	11+	10+	5+
1875	60+	15+	14+	2+
1876	20+	12+	2+	5+

Comparative health of squadrons as determined by their respective death-rates.

Death-rate per thousand of aggregate number of men.

	1.		2.		3.		4.		5.		6.	
1865	West Indies	42	Mississippi	41	European	20	Atlantic	18	Iron clads	17	Gulf	11
1866	Asiatic	19	Gulf	17	North Atlantic	14	European	14	South Atlantic	13	Special service	13
1867	Coast Survey	68	North Atlantic	36	North Pacific	27	South Atlantic	14	South Pacific	11	Asiatic	9
1868	Asiatic	13	South Pacific	10	North Atlantic	9	North Pacific	9	European	6	Special service	3
1869	South Atlantic	8	Pacific	6	European	4	North Atlantic	4	Asiatic	4	School and practice	3
1870	Special service	8	South Atlantic	5	Pacific	5	Asiatic	4	North Atlantic	4	European	3
1871	Asiatic	12	European	9	South Atlantic	7	School and practice	6	North Atlantic	5	Pacific	5
1872	North Atlantic	8	European	6	Asiatic	4	Pacific	3	South Atlantic	3	Special service	1
1873	European	7	South Atlantic	6	Pacific	5	Asiatic	4	Special service	2	North Atlantic	2
1874	Asiatic	8	European	7	Pacific	5	North Atlantic	3	South Atlantic	2	Special service	1
1875	South Atlantic	13	Asiatic	5	Pacific	5	European	4	Special service	3	North Atlantic	2
1876	Special service	13	Asiatic	6	South Atlantic	6	Pacific	5	European	5	School and practice	2

	7.		8.		9.		10.		11.		12.		13.	
1865	Asiatic	9	Brazil	7	Special service	6	Pacific	6	School and practice	5	Potomac	1	Coast Survey	0
1866	Coast Survey	7	North Pacific	7	South Pacific	5	School and practice	4						
1867	Special service	8	European	5	School and practice	0								
1868	South Atlantic	2	School and practice	1	Coast Survey	0								
1869	Special service	2	Coast Survey	0										
1870	Coast Survey	0	School and practice	0										
1871	Special service	4	Coast Survey	0										
1872	Coast Survey	0	School and practice	0										
1873	Coast Survey	0	School and practice	0										
1874	Coast Survey	0	School and practice	0										
1875	School and practice	2	Coast Survey	0										
1876	North Atlantic	1	Coast Survey	0										

INSANE OF THE NAVY.

On the 30th September, 1876, there remained under treatment in the Government Hospital for the Insane 2 commanders, 2 lieutenant-commanders, 1 assistant engineer, 1 late ensign, 1 mate, 11 seamen, 1 ordinary seaman, 3 ordinary seamen extra, 1 seaman extra fireman, 1 coal-heaver, 8 marines, 3 beneficiaries; total... 48

Admitted during the year ending September 30, 1877, 1 beneficiary, 2 marines, 2 landsmen, and 1 second-class fireman 6

Total number under treatment during the year 54

Discharged during the year ending September 30, 1877, 1 mate, 2 seamen, 1 ordinary seaman extra, 1 coal-heaver, 5 landsmen, 1 late landsman, 3 marines, 1 beneficiary; total 15

Remaining at the end of the year, 2 commanders, 2 lieutenant-commanders, 1 assistant engineer, 1 late ensign, 9 seamen, 1 ordinary seaman, 2 ordinary seamen extra, 1 seaman extra fireman, 1 late seaman, 8 landsmen, 7 marines, 3 beneficiaries, 1 second-class boy; total 39

In the Insane Asylum of California there are 2 marines, 1 seaman, and 1 coal-heaver; total 4

Alaska, *2d rate. Screw; wood;* 1,122 *tons.*

[Employed on the European station, west coast of Africa, and Home station for 279 days (1st, 2d, and 3d quarters, and 5 days of 4th quarter) of the year 1876. Average number of ship's company for that period, 243; total sick-days, 1,586, representing the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		12	12				
Enthetic	1	5	6				
Dietic		1	1				
Diathetic	1	13	14				
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye		7	7				
ear							
teeth							
circulatory system		3	2			1	
respiratory system		8	6		2		
digestive system	2	16	17			1	
urinary and genital system		1				1	
locomotive system		3	3				
integumentary system		15	12		3		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	15	16				
Total	5	99	96		5	3	

Alert, 3d *rate.* *Screw; iron;* 541 *tons.*

[Employed during the year 1876 fitting out, *en route*, and on the Asiatic station. Average number of ship's company, 150; total sick-days, 1,180, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		13	13				
Enthetic		4	3				1
Dietic		1	1				
Diathetic	1	8	6	2	1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		5	2	1	1		1
eye		1	1				
ear							
teeth							
circulatory system		3	3				
respiratory system		3	2				1
igestive system	1	27	24		1	1	2
urinary and genital system		5	5				
locomotive system							
integumentary system	1	5	6				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	43	41		3		
Total	4	118	107	3	6	1	5

Ashuelot, 3d *rate.* *Paddle-wheel; iron;* 786 *tons.*

[Employed during the year 1876 on the Asiatic station. Average number of ship's company, 130; total sick-days, 1,221, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		30	30				
Enthetic		8	7				1
Dietic		1	1				
Diathetic		8	7	1			
Developmental		1			1		
Tubercular							
Parasitic		1	1				
Of the nervous system		4	4				
eye		1	1				
ear		1	1				
teeth		1	1				
circulatory system							
respiratory system		3	3				
digestive system	1	53	51	2			1
urinary and genital system		3	3				
locomotive system		1		1			
integumentary system		15	13	1			1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	2	20	21		1		
Total	3	151	144	5	2		3

Adams, *3d rate. Screw; wood;* 615 *tons.*

[Employed for 160 days of the year 1876 (68 days 3d quarter, 92 days 4th quarter) on the Home station. Average number of ship's company, 200; total sick-days, 311, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	1	......	......	1	......	......
Enthetic	......	4	4	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	2	2	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	2	1	1	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	3	3	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	4	3	......	1	......	......
digestive system	......	1	1	......	......	......	......
urinary and genital system	......	1	1	......	......	......	......
locomotive system	......	1	1	......	......	......	......
integumentary system	......	3	2	......	......	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	13	11	......	1	......	1
Total	......	35	29	1	3	......	2

Ajax, *4th rate. Screw; iron-clad;* 550 *tons.*

[Employed for 140 days in the year 1876 (38 days 1st quarter, 91 days 2d quarter, 11 days 3d quarter), on the Home station. Average number of ship's company, 62+; total sick days, 163, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	2	1	......	1	......	......
Enthetic	......	1	1	......	......	......	......
Dietic	......	1	1	......	......	......	......
Diathetic	......	2	2	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	1	1	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	1	1	......	......	......	......
digestive system	......	......	......	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	2	2	......	......	......	......
integumentary system	......	2	2	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	....	4	3	......	1	......	......
Total	......	16	14	......	2	......	......

Alarm, 4th rate. Wheel; iron; 311 *tons.*

[Torpedo-boat. Employed for 182 days (1st and 2d quarters), 1876, on the Home station. Average number ship's company, 49 +; total sick days, 351, divided under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		24	23		1		
Enthetic		3	3				
Dietic		1	1				
Diathetic		7	5		1		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system		2	2				
digestive system		11	9				2
uriuary and genital system		2			1		1
locomotive system							
integumentary system		1	1				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		9	9				
Total		60	53		3		4

Brooklyn, 2d rate. Screw; wood; 2,000 *tons.*

[Employed for 203 days of the year 1876, on the Home station (1st and 2d quarters, and 21 days of 3d quarter). Average number of ship's company for that period, 246; total sick days, 1,288, with the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		3	3				
Enthetic	1	10	8		3		
Dietic		6	6				
Diathetic	1	13	11	1	2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system	2	5	5	1	1		
eye		1			1		
ear							
teeth							
circulatory system	1	1			2		
respiratory system		25	23	1	1		
digestive system	1	35	34	1	1		
urinary and genital system		7	5	1	1		
locomotive system							
integumentary system		8	7	1			
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	30	30	1			
Total	7	144	132	7	12		

Bache. Coast Survey.

[For the year 1876. Norfolk, Fernandina, Saint Augustine. Average number ship's company, 31 —; total sick days, 165.

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		4	4				
Enthetic		4	4				
Dietic		1	1				
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1	1				
eye							
ear							
teeth							
circulatory system							
respiratory system		2	2				
digestive system		3	2				1
urinary and genital system							
locomotive system							
integumentary system	1	1	1		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		3	3				
Total	1	20	19		1		1

Blake. Coast Survey.

[For 274 days of the year 1876 (1st, 2d, and 3d quarters), New Orleans, La. Average number of ship's company, 46; total sick, days 358.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	11	13				1
Enthetic		12	12				
Dietic		1	1				
Diathetic		3	3				
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye		2	2				
ear							
teeth		2	2				
circulatory system		1	1				
respiratory system		6	5		1		
digestive system		22	21	1			
urinary and genital system		4	4				
locomotive system							
integumentary system		8	8				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		5	5				
Total	3	77	77	1	1		1

Congress, 2d rate. Screw; wood; 2,000 *tons.*

[Employed during the year1876, 182 days (1st and 2d quarters), on the Home station. Average crew for that period, 294; total sick days, 849, grouped under the following diseases.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic		5	3		2		
Dietic		1	1				
Diathetic		5	2		3		
Developmental		1			1		
Tubercular							
Parasitic							
Of the nervous system	3				3		
eye		3	1		2		
ear							
teeth							
circulatory system		3	1	1	1		
respiratory system	1				1		
digestive system		7	5		2		
urinary and genital system	1	9	4	1	5		
locomotive system							
integumentary system	2	3	4		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	22	18	4	1		
Total	8	59	39	6	22		

Constellation, 3d rate. Sails; wood; 1,236 *tons.*

[Employed for 124 days of the year 1876 on the Home station (39 days 2d quarter, 85 days in 2d quarter), as practice-ship. Average number of ship's company for that period, 328; total sick days, 307, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic		6	3		3		
Dietic		1	1				
Diathetic		2			2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		2	1		1		
eye		1			1		
ear							
teeth							
circulatory system							
respiratory system							
digestive system		1	1				
urinary and genital system							
locomotive system							
integumentary system		10	9		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		16	15		1		
Total		41	32		9		

Catskill, 4th *rate. Screw; iron-clad;* 496 *tons.*

[Employed at Port Royal, S. C., on the Home station for 182 days of the year 1876 (1st and 2d quarters). Average number of ship's company for that period, 63+, with a total number of sick days, 157, grouped under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic		1			1		
Dietic		1	1				
Diathetic		4	3				1
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system		8	7	1			
digestive system		5	5				
urinary and genital system							
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		4	3	1			
Total		23	19	2	1		1

Canonicus, 4th *rate. Iron-clad; screw;* 550 *tons.*

[Employed during the year 1876 at New Orleans, La., on the Home station. Average number of ship's company, 72; total sick days, 699, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		14	14				
Enthetic		12	12				
Dietic		1	1				
Diathetic		5	5				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		6	4		1	1	
eye							
ear							
teeth							
circulatory system							
respiratory system		4	3			1	
digestive system		8	8				
urinary and genital system							
locomotive system							
integumentary system		6	6				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	10	9		1		1
Total	1	66	62		2	2	1

Dictator, 2d rate. Iron-clad; screw; 1,750 tons.

[Employed during the year 1876 at Port Royal, S. C., on the Home station. Average number of ship's company, 104+; total sick days, 810, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	8	9				
Enthetic		1	1				
Dietic							
Diathetic		4	4				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		5	3				2
eye		1	1				
ear		3	3				
teeth							
circulatory system		4	4				
respiratory system		7	7				
digestive system		8	7	1			
urinary and genital system		3	3				
locomotive system							
integumentary system	1	16	17				
Non-malignant tumors and cysts		1			1		
Wounds, injuries, and accidents		9	9				
Total	2	70	68	1	1		2

Despatch, 4th rate. Screw; wood; 730 tons.

[Employed on special service on the Home station during the year 1876. Average number of ship's company, 46—; total sick days, 344, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		6	6				
Enthetic		3	2		1		
Dietic							
Diathetic		1			1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		2	2				
eye		3	3				
ear							
teeth							
circulatory system		1	1				
respiratory system							
digestive system		9	8		1		
urinary and genital system							
locomotive system		3	3				
integumentary system		2	2				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		2	1		1		
Total		32	28		4		

Essex, 3d *rate. Screw; wood;* 615 *tons.*

[Employed for 91 days (1st quarter 1876) of the year 1876 at Hampton Roads, Va., on the Home station. Average number of ship's company for that period, 207; total sick days, 226, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic		2			1		1
Dietic		1	1				
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1					1
eye							
ear							
teeth							
circulatory system							
respiratory system		2			2		
digestive system		4	4				
urinary and genital system							
locomotive system		2	1				1
integumentary system		2	2				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		13	12		1		
Total		30	23		4		3

Franklin, 1st *rate. Screw; wood;* 3,173 *tons.*

[Employed during the year 1876 on the European station. Average number of ship's company for the period 566; total sick days 5,462, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	80	81				
Enthetic	2	40	38	1	3		
Dietic		2	2				
Diathetic	2	32	33		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system	2	13	11	1	2		1
eye		7	7				
ear							
teeth							
circulatory system		6	6				
respiratory system	5	39	38		4	2	
digestive system	1	84	84				1
urinary and genital system		10	9		1		
locomotive system		2	2				
integumentary system	3	75	75		1	1	1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	6	132	136				2
Total	22	522	522	2	12	3	5

Frolic, 4th rate. Paddle-wheel; iron; 614 *tons.*

[Was employed in the Rio de la Plata for 182 days of the year 1876 (1st and 2d quarters), on the South Atlantic squadron. Average number of ship's company for that period, 108; total sick days, 644, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic		6	6				
Dietic							
Diathetic	1	7	6		1		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system		4	3		1		
eye							
ear		1	1				
teeth							
circulatory system		2	1		1		
respiratory system		4			4		
digestive system		11	8	1	1		1
urinary and genital system		3	2		1		
locomotive system							
integumentary system		1	1				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		7	7				
Total	1	48	37	1	9		2

Gettysburg, 4th rate. Paddle-wheel; iron; 518 *tons.*

[For 274 days of the year 1876 (1st, 2d, and 4th quarters), was employed on the Home station and *en route* to the European station, and on that station. Average number of ship's company for that period, 73; total sick days, 759, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		6	6				
Enthetic	1	5	5		1		
Dietic							
Diathetic		5	2		1		2
Developmental							
Tubercular							
Parasitic		1	1				
Of the nervous system		7	6		1		
eye		1	1				
ear							
teeth							
circulatory system							
respiratory system		5	5				
digestive system		19	17		2		
urinary and genital system		1	1				
locomotive system							
integumentary system		6	5				1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		19	19				
Total	1	75	68		5		3

Gedney. Coast Survey steamer.

[For the year 1876. Average number ship's company, 34; total sick days, 45.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	6	6	......	......	......	......
Enthetic	......	1	1	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	2	2	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	2	2	......	......	......	......
digestive system	......	3	3	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	1	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	2	2	......	......	......	......
Total	......	17	17	......	......	......	......

Hartford, 2d rate. Screw; wood; 2,000 tons.

[Employed during the year 1876 on the Home station. The average number of the ship's company was 331; total sick days, 2,836, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	51	38	......	14	......	......
Enthetic	......	18	8	......	9	......	1
Dietic	......	2	2	......	......	......	......
Diathetic	......	38	25	5	8	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	1	1	......	......	......	......
Of the nervous system	......	22	14	2	4	1	1
eye	......	6	5	......	1	......	......
ear	......	2	2	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	7	5	......	2	......	......
respiratory system	1	20	17	......	3	......	1
digestive system	......	31	24	......	6	......	1
urinary and genital system	......	6	3	......	3	......	......
locomotive system	......	3	1	......	2	......	......
integumentary system	......	38	34	3	......	......	1
Non-malignant tumors and cysts	......	1	......	......	1	......	......
Wounds, injuries, and accidents	2	59	52	1	8	......	......
Total	4	305	231	11	61	1	5

Huron, 3d rate. Screw; iron; 541 *tons.*

[Employed during the year 1876 on the Home station. The average number of the ship's company was 132; total sick days, 832, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	10	10		1		
Enthetic		10	10				
Dietic		1	1				
Diathetic		9	7		2		
Developmental		1			1		
Tubercular							
Parasitic							
Of the nervous system		4	4				
eye							
ear							
teeth							
circulatory system							
respiratory system		10	10				
digestive system		21	20		1		
urinary and genital system		2	2				
locomotive system							
integumentary system		14	12		2		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		19	16		1		2
Total	1	101	92		8		2

Intrepid, 4th rate. Torpedo-boat; screw; iron; 438 *tons.*

[Employed for 182 days of the year 1876 on the Home station (1st and 2d quarters). The average number of the ship's company for that period was 52. Total sick days, 194, grouped under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic		3	3				
Dietic		1	1				
Diathetic		3	3				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1	1				
eye		1					1
ear							
teeth							
circulatory system		1	1				
respiratory system		3	3				
digestive system		7	7				
urinary and genital system		2	2				
locomotive system							
integumentary system		3	3				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		8	8				
Total		33	32				1

Juniata, 3d *rate*. *Screw; wood;* 828 *tons*.

[For 249 days of the year 1876 (1st and 2d quarters, and 67 days of 3d quarter) was employed on the Home station. The average number of ship's company for that period was 192, with 1,492 sick days, grouped under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		7	6			1	
Enthetic		12	12				
Dietic		1	1				
Diathetic		21	20		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		8	8				
eye		2	1		1		
ear		1			1		
teeth							
circulatory system							
respiratory system		42	41		1		
digestive system		32	32				
urinary and genital system		1	1				
locomotive system		1			1		
integumentary system		17	17				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		45	43		1	1	
Total		190	182		6	2	

Kearsarge, 3d *rate*. *Screw; wood;* 695 *tons*.

[Employed in the year 1876 on the Asiatic station. Average number of ship's company for that period, 181. Total sick days, 2,219, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	43	41		2	1	
Enthetic	1	40	35		3		3
Dietic		8	7		1		
Diathetic		4	4				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		10	9		1		
eye	1	1	2				
ear							
teeth							
circulatory system		1			1		
respiratory system		14	6		8		
digestive system	1	90	91				
urinary and genital system	1	5	4				2
locomotive system		1	1				
integumentary system	2	45	45				2
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	2	44	45				1
Total	9	306	290		16	1	8

Lackawanna, 2d rate. Screw; wood; 1,026 *tons.*

[Employed during the year 1876 on the North Pacific station. Average ship's company for that period, 214; total sick days, 1,870, grouped under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		12	12				
Enthetic		13	11				2
Dietic		2	1				1
Diathetic		9	7		2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		8	8				
eye		1	1				
ear							
teeth							
circulatory system							
respiratory system		18	13	1	1	1	2
digestive system		3	3				
urinary and genital system		5	5				
locomotive system							
integumentary system		8	8				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	25	23			1	2
Total	1	104	92	1	3	2	7

Lehigh, 4th rate. Screw; iron-clad; 496 *tons.*

[Employed for 116 days of the year 1876 (66 days 1st quarter, 91 days 2d quarter, 11 days 3d quarter) at Norfolk, Va., on the Home station. Average number of crew for that period, 65; total sick days, 102, grouped under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		1	1				
Enthetic		1			1		
Dietic							
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1			1		
eye							
ear							
teeth							
circulatory system							
respiratory system		2	2				
digestive system		1			1		
urinary and genital system							
locomotive system							
integumentary system		1	1				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		3	2				1
Total		11	7		3		1

Minnesota, 1st rate. Screw; wood; 3,000 tons.

[Employed during the year 1876 at New York, N. Y., on the Home station. Average number of ship's company, 388; total sick days, 1,244, grouped under the following diseases. This vessel is used as a training-ship.]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	8	5	......	3	......	......
Enthetic	1	10	8	......	2	......	1
Dietic	......	1	1	......	......	......	......
Diathetic	......	22	12	......	9	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	5	2	1	2	......	......
eye	......	9	8	1	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	1	10	8	......	3	......	......
digestive system	......	17	16	......	1	......	......
urinary and genital system	......	3	2	......	1	......	......
locomotive system	1	1	1	......	1	......	......
integumentary system	......	21	19	......	......	......	2
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	32	28	......	2	1	1
Total	3	139	110	2	24	1	5

Monongahela, 2d rate. Screw; wood; 960 tons.

[Employed for 311 days of the year 1876 on the Home station. The average number of the ship's company for that period was 215; total sick days, 1,570, grouped under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	85	84	......	......	......	1
Enthetic	1	10	8	....	2	......	1
Dietic	......	8	7	......	......	......	1
Diathetic	1	17	16	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	2	2	......	......	......	......
eye	......	2	2	......	......	......	......
ear	......	2	2	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	1	2	2	......	1	......	......
respiratory system	2	24	24	......	2	......	......
digestive system	......	30	30	......	......	......	......
urinary and genital system	1	......	......	......	1	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	1	16	16	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	3	35	35	......	2	......	1
Total	10	233	228	......	11	......	4

Monocacy, 3d *rate. Paddle; iron;* 746 *tons.*

[Employed during the year 1876 on the Asiatic station. Average number of ship's company for that time, 126; total sick days, 1,114, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		4	4				
Enthetic	1	13	13	1			
Dietic		1				1	
Diathetic		3	1		1		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system		7	7				
eye							
ear		5	5				
teeth							
circulatory system							
respiratory system		3	3				
digestive system	2	8	9			1	
urinary and genital system		7	7				
locomotive system							
integumentary system		8	6		1		1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		8	8				
Total	3	67	63	1	2	2	2

Michigan, 3d *rate. Paddle; iron;* 450 *tons.*

[Employed during the year 1876 on the Lakes. Average number of ship's company, 107; total sick days, 876, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic							
Dietic		5	5				
Diathetic		6	6				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		5	5				
eye		2	2				
ear							
teeth		1	1				
circulatory system		1	1				
respiratory system		27	23	3		1	
digestive system	1	35	35	1			
urinary and genital system	1	1	2				
locomotive system		3	2	1			
integumentary system		8	8				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	18	17	1		1	
Total	3	114	109	6		2	

Marion, 3d rate. *Screw; wood;* 910 *tons.*

[Employed for 355 days of the year 1876, *en route* to the European station. The average number of the ship's company for that period was 250; total sick days, 2,546, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	16	16	......	......	......	......
Enthetic	......	17	15	......	......	......	2
Dietic	......	......	......	......	......	......	......
Diathetic	......	36	36	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	9	7	......	2	......	......
eye	......	5	5	......	......	......	......
ear	......	3	3	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	1	1	......	......	......	......
respiratory system	......	41	40	......	1	......	......
digestive system	......	53	52	......	1	......	......
urinary and genital system	......	16	10	......	6	......	......
locomotive system	......	1	1	......	......	......	......
integumentary system	......	61	59	......	......	......	2
Non-malignant tumors and cysts	......	1	1	......	......	......	......
Wounds, injuries, and accidents	......	85	82	......	1	......	2
Total	......	345	328	......	11	......	6

Montauk, 4th rate. *Screw; iron-clad;* 496 *tons.*

[Employed for 157 days (1st and 2d quarters, 1876), of the year 1876 at Norfolk, Va., on the Home station. Average number of ship's company, 66; total sick days, 41, presented by the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	3	2	......	1	......	......
Enthetic	......	1	......	......	1	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	2	......	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	1	......	......	1	......	......
digestive system	......	1	......	......	1	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	......	......	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	1	1	......	......	......	......
Total	......	9	3	......	6	......	......

Manhattan, 4th *rate.* *Screw; iron-clad;* 550 *tons.*

[For 182 days (1st and 2d quarters, 1876) of the year was employed at Pensacola, Fla., on the Home station. Average ship's company for the period, 63, with 114 sick days, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic							
Dietic							
Diathetic		8	7		1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1	1				
eye							
ear							
teeth							
circulatory system							
respiratory system		7	6		1		
digestive system		2	1		1		
urinary and genital system							
locomotive system							
integumentary system		1	1				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		3	1				2
Total		24	19		3		2

Mahopac, 4th *rate.* *Screw; iron-clad;* 550 *tons.*

[Employed for 91 days (1st quarter) of the year 1876, at Port Royal, S. C., on the Home station. Average number of ship's company, 57; total sick days, 149, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		3	3				
Enthetic							
Dietic							
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system	1	2	3				
eye	1		1				
ear							
teeth							
circulatory system							
respiratory system		2	2				
digestive system		4	4				
urinary and genital system							
locomotive system							
Integumentary system	1	6	6	1			
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		3	3				
Total	3	21	23	1			

Nantucket, 4th rate. Screw; iron-clad; 496 *tons.*

[Was employed for 64 days in the year 1876 on the Home station, at Norfolk, Va. The average ship's company for that period was 70; total sick days, 87, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		2	2				
Enthetic		1	1				
Dietic							
Diathetic		1	1				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		2	2				
eye		1	1				
ear							
teeth							
circulatory system							
respiratory system		1	1				
digestive system							
urinary and genital system		1			1		
locomotive system							
integumentary system		3	3				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		4	4				
Total		16	15		1		

New Hampshire, 2d rate. Sails; wood; 2,600 *tons.*

[For 275 days of the year 1876 was employed on the Home station, at Port Royal, S. C. The average ship's company for that period was 114+; total sick days, 497, with the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		8	8				
Enthetic		2	2				
Dietic		1	1				
Diathetic		9	8	1			
Developmental							
Tubercular							
Parasitic							
Of the nervous system		2	1				1
eye		1			1		
ear							
teeth							
circulatory system		1			1		
respiratory system		3	3				
digestive system		9	9				
urinary and genital system		1			1		
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		3	3				
Total		40	35	1	3		1

Onward, 4th rate. Sails; wood; 804 *tons.*

[Employed as the store-ship of the South Pacific squadron during the year 1876, at Callao, Peru. Average ship's company, 59+; total sick days, 397, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	8	8	......	......	......	......
Enthetic	......	1	1	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	1	2	3	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	4	3	......	1	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	2	2	......	......	......	......
respiratory system	......	1	......	......	......	......	1
digestive system	1	4	4	......	......	......	1
urinary and genital system	......	2	2	......	......	......	......
locomotive system	......	1	......	......	1	......	......
integumentary system	......	7	7	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	2	8	9	......	......	1	......
Total	4	40	39	......	2	1	2

Omaha, 2d rate. Screw; wood; 1,122 *tons.*

[Was employed during the year 1876 on the South Pacific station. Average number of ship's company, 226; total sick days, 4,113, grouped under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	55	55	......	......	......	2
Enthetic	4	63	62	......	1	......	4
Dietic	......	14	14	......	......	......	......
Diathetic	3	37	38	......	2	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	6	6	......	......	......	......
eye	......	1	1	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	4	2	......	2	......	......
respiratory system	......	28	27	......	1	......	......
digestive system	1	67	64	......	2	1	1
urinary and genital system	1	12	11	......	1	......	1
locomotive system	......	1	1	......	......	......	......
integumentary system	2	26	28	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	2	55	56	......	1	......	......
Total	15	369	365	......	10	1	8

Ossipee, 3d rate. Screw; wood; 828 tons.

[Was employed on the Home station during the year 1876. The average number of the ship's company was 194+, with a total of 1,018 sick days for the 2d, 3d, and 4th quarters, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		9	9				
Enthetic	2	6	5		1		2
Dietic							
Diathetic		10	7	1	1		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system		15	14		1		
eye		2	2				
ear		2	1		1		
teeth		1	1				
circulatory system		6	4		2		
respiratory system	1	40	31		9	1	
digestive system	2	39	38		2		1
urinary and genital system		5	4				1
locomotive system		2	2				
integumentary system		18	16		2		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		37	37				
Total	5	192	171	1	19	1	5

Powhatan, 2d rate. Paddle-wheel; wood; 2,182 tons.

Was employed during the year 1876 on the Home station. Average number of ship's company for that period, 225; total sick days, 2,688, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		26	25		1		
Enthetic	2	22	19	2	1		2
Dietic		3	3				
Diathetic	2	15	12		4		1
Developmental							
Tubercular							
Parasitic							
Of the nervous system		3	3				
eye		4	2	1	1		
ear		2	2				
teeth							
circulatory system		3	1		2		
respiratory system	1	26	19		6		2
digestive system		22	21		1		
urinary and genital system		5	4		1		
locomotive system							
integumentary system	1	26	19		7		1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	43	41	2	1		
Total	7	200	171	5	25		6

Plymouth, 2d rate. Screw; wood; 1,122 *tons.*

[Employed during the year 1876 on the Home station. The average ship's company for that period was 239; total sick days, 1,505, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	14	9	......	4	......	1
Enthetic	2	12	10	......	4	......	......
Dietic	......	5	5	......	......	......	......
Diathetic	2	24	19	2	4	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	1	14	9	2	4	......	......
eye	......	4	3	......	1	......	......
ear	......	3	......	......	3	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	2	......	......	2	......	......
respiratory system	......	27	23	......	3	1	......
digestive system	......	23	19	1	2	1	......
urinary and genital system	1	5	3	......	3	......	......
locomotive system	......	3	2	......	1	......	......
integumentary system	3	23	24	......	2	......	......
Non-malignant tumors and cysts	......	1	......	......	1	......	......
Wounds, injuries, and accidents	......	33	24	......	6	2	1
Total	9	193	150	5	40	4	3

Portsmouth, 3d rate, 2d class. Sails; wood; 846 *tons.*

[For 272 days of 1876 (1st, 2d, and 3d quarters) employed on the Pacific station. Average number of ship's company, 123; total sick days, 941, presented by the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	......	......	......	......	......	......
Enthetic	......	3	3	......	......	......	......
Dietic	......	1	1	......	......	......	......
Diathetic	......	9	6	......	1	......	......
Developmental	......	2	......	......	2	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	8	6	......	2	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	5	1	1	3	......	......
respiratory system	6	41	45	......	2	......	......
digestive system	......	15	15	......	......	......	......
urinary and genital system	......	2	2	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	11	11	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	38	35	......	2	......	1
Total	6	135	127	1	12	......	1

Palos, *4th rate. Screw; iron;* 306 *tons.*

[Employed during the year 1876 on the Asiatic station. The average number of the ship's company for that period was 50, with a total number of sick days of 379, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		1	1				
Enthetic		1	1				
Dietic							
Diathetic		4	4				
Developmental							
Tubercular							
Parasitic							
Of the nervous system		6	5		1		
eye		1			1		
ear							
teeth							
circulatory system							
respiratory system		10	10				
digestive system		18	16		1		1
urinary and genital system		5	4	1			
locomotive system							
integumentary system		8	8				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		9	9				
Total		63	58	1	3		1

Pensacola, *2d rate. Screw; wood;* 2,000 *tons.*

[Was employed on the Pacific station for the year 1876. The average number of the ship's company for that period was 327; total sick days, 3 551, presented under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		35	32		1		2
Enthetic	1	19	18		2		
Dietic		27	26		1		
Diathetic	1	40	36		3		2
Developmental							
Tubercular		1	1				
Parasitic							
Of the nervous system		55	49		6		
eye		6	5		1		
ear		1	1				
teeth							
circulatory system		3	1		2		
respiratory system	2	36	27	6	4		1
digestive system		71	68		3		
urinary and genital system		5	5				
locomotive system		1	1				
integumentary system	2	65	66		1		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	4	104	87	20	1		
Total	10	469	423	26	25		5

Passaic, 4*th rate. Screw; iron-clad;* 496 *tons.*

[Employed at Norfolk, Va., for 182 days of the year 1876. Average number of ship's company for that period, 70; total sick days, 82, with the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	3	2	......	1	......	......
Enthetic	......	3	2	......	1	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	2	1	......	1	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	2	......	......	2	......	......
digestive system	......	1	1	......	......	......	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	......	......	......	1	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	2	2	......	......	......	......
Total	......	14	8	......	5	1	......

Passaic, 4*th rate. Screw; iron-clad;* 496 *tons. Montauk*, 4*th rate. Screw; iron-clad*, 496 *tons. Wyandotte*, 4*th rate. Screw; iron-clad;* 550 *tons.*

[Were employed for 184 days of 1876 at Norfolk, Va., on the Home station. The average crew of the 3 vessels was 85, with a total of 104 sick days, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	6	3	......	3	......	......
Enthetic	......	1	1	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	4	1	......	3	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	3	3	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	......	......	......	......	......	......
digestive system	......	2	1	......	1	......	......
urinary and genital system	......	2	2	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	......	......	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	1	1	......	......	......	......
Total	......	19	12	......	7	......	......

Pinta, 4th rate. Screw-tug; 306 *tons.*

[From the reports was employed for 91 days of the year 1876 at Norfolk, Va., on the Home station. The average crew was 30, with a total of 46 sick days, with the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		1	1				
Enthetic		1	1				
Dietic							
Diathetic		3	3				
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system		3	3				
digestive system							
urinary and genital system							
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		2	2				
Tatal		10	10				

Pawnee, 3d rate, 2d class. Sails; wood; 872 *tons.*

[From the reports has been employed for 91 days of the year 1876 on the Home station as store-ship at Port Royal, S.C. The average crew was 42, with a total of 256 sick days, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic							
Dietic							
Diathetic		1			1		
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye		2	2				
ear							
teeth							
circulatory system							
respiratory system							
digestive system		2			1		1
urinary and genital system							
locomotive system		1			1		
integumentary system		4	3				1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	2	1	1			1
Total	1	12	6	1	3		3

Richmond, 2d rate. Screw; wood; 2,000 tons.

[For the year 1876 was employed on the Pacific station and on her way home. The average number of the ship's company for that period was 427, with a total of 3,913 sick days, presented under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	26	25	.....	1	.....	1
Enthetic	.....	51	47	.....	1	.....	3
Dietic	.....	3	3	.....	.....	.....	.....
Diathetic	.....	4	4	.....	.....	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	1	1	.....	.....	.....	.....
Of the nervous system	.....	2	1	.....	.....	.....	1
eye	.....	8	7	.....	.....	1	.....
ear	.....	.....	.....	.....	.....	.....	.....
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	2	.....	.....	1	1	.....
respiratory system	1	12	11	.....	1	.....	1
digestive system	2	33	32	.....	1	.....	2
urinary and genital system	.....	5	4	.....	1	.....	.....
locomotive system	.....	.....	.....	.....	.....	.....	.....
integumentary system	.....	57	55	.....	.....	.....	2
Non-malignant tumors and cysts	.....	.....	.....	.....	.....	.....	.....
Wounds, injuries, and accidents	2	56	55	.....	.....	.....	3
Total	6	260	245	.....	6	2	13

Rio Bravo, 4th rate. Paddle-wheel; 325 tons.

[For the year 1876, was employed on the Home station, in the Gulf of Mexico, off Brownsville, Tex., and Matamoras, Mexico. The average ship's company for the year was 49, with a total of 931 sick days, under the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	.....	7	7	.....	.....	.....	.....
Enthetic	1	6	7	.....	.....	.....	.....
Dietic	.....	.....	.....	.....	.....	.....	.....
Diathetic	.....	5	5	.....	.....	.....	.....
Developmental	.....	.....	.....	.....	.....	.....	.....
Tubercular	.....	.....	.....	.....	.....	.....	.....
Parasitic	.....	1	1	.....	.....	.....	.....
Of the nervous system	.....	6	6	.....	.....	.....	.....
eye	.....	1	1	.....	.....	.....	.....
ear	.....	.....	.....	.....	.....	.....	.....
teeth	.....	.....	.....	.....	.....	.....	.....
circulatory system	.....	.....	.....	.....	.....	.....	.....
respiratory system	.....	10	10	.....	.....	.....	.....
digestive system	.....	16	16	.....	.....	.....	.....
urinary and genital system	.....	4	4	.....	.....	.....	.....
locomotive system	.....	.....	.....	.....	.....	.....	.....
integumentary system	.....	4	4	.....	.....	.....	.....
Non-malignant tumors and cysts	.....	1	1	.....	.....	.....	.....
Wounds, injuries, and accidents	.....	15	15	.....	.....	.....	.....
Total	1	76	77	.....	.....	.....	.....

Ranger, *3d rate. Screw; iron;* 541 *tons.*

[On the Home station, and on the way to the Asiatic station. Average number of crew, 136; with a total of 4 sick-days presenting the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic							
Enthetic							
Dietic							
Diathetic							
Developmental							
Tubercular							
Parasitic							
Of the nervous system							
eye							
ear							
teeth							
circulatory system							
respiratory system		1	1				
digestive system		1	1				
urinary and genital system							
locomotive system							
integumentary system							
Non-malignant tumors and cysts							
Wounds, injuries, and accidents							
Total		2	2				

Saco, 3d rate. Screw; wood; 410 *tons.*

[For 195 days of the year 1876 was employed on the Asiatic station. The average ship's company for that period was 121, with 1,343 sick-days, with the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		4	4				
Enthetic	1	15	14		2		
Dietic		1	1				
Diathetic	2	18	13		7		
Developmental		1			1		
Tubercular							
Parasitic							
Of the nervous system		4	1		3		
eye		1	1				
ear							
teeth							
circulatory system		3			3		
respiratory system		8	5	2	1		
digestive system		6	5	1			
urinary and genital system	1	3	4				
locomotive system		1			1		
integumentary system	1	5	6				
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	2	7	9				
Total	7	77	63	3	18		

Swatara, 3d rate. Screw; wood; 910 *tons.*

[For the year 1876 was employed on the Home station. The average ship's company for the year wa 172, with 2,218 sick-days, exhibited by the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	13	11	1	2	......	......
Enthetic	......	8	6	......	1	......	1
Dietic	......	3	3	......	......	......	......
Diathetic	2	21	19	......	4	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	1	19	15	1	4	......	......
eye	......	1	1	......	......	......	......
ear	......	1	......	......	1	......	......
teeth	......	......	......	......	......	......	......
circulatory system	1	2	......	......	3	......	......
respiratory system	......	17	15	......	1	......	1
digestive system	3	42	37	1	7	......	......
urinary and genital system	2	2	1	......	3	......	......
locomotive system	1	......	......	......	1	......	......
integumentary system	......	22	20	......	1	......	1
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	55	46	......	8	......	1
Total	11	206	174	3	36	......	4

Saugus, 4th rate. Screw; iron-clad; 550 *tons.*

[For 111 days in the year 1876 was employed on the Home station. The average ship's company for that time was 61 +, with 170 sick-days, presenting the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	2	2	......	......	......	......
Enthetic	......	3	3	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	6	5	......	1	......	......
Developmental	......	1	......	......	1	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	1	1	......	......	......	......
eye	......	1	1	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	1	1	......	......	......	......
respiratory system	......	7	7	......	......	......	......
digestive system	......	2	1	......	1	......	......
urinary and genital system	......	1	......	......	1	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	1	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	6	4	......	2	......	......
Total	......	32	26	......	6	......	......

Supply, 4th rate. Sails ; wood ; 547 *tons.*

[For 274 days of 1876 was employed on the Home station. The average ship's company for that time was 84, with 327 sick-days, under the following diseases :]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.‡	Remaining.
Miasmatic	......	1	1	......	......	......	......
Enthetic	......	3	3	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	2	1	......	1	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	1	......	......	1	......	......
ear	......	....	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	2	2	......	......	......	......
digestive system	......	3	3	......	......	......	......
urinary and genital system	......	1	1	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	......	......	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	6	4	......	2	......	......
Total	......	19	15	......	4	......	......

Shawmut, 3d rate. Screw; wood; 410 *tons.*

[For the year 1876 was employed on the Home station. The average number of the ship's company was 116, with 1,388 sick-days, presenting the following diseases :]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	1	21	22	......	......	......	......
Enthetic	1	13	13	......	......	......	1
Dietic	......	......	......	......	......	......	......
Diathetic	......	15	15	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	1	......	......	1	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	7	6	1	......	......	......
eye	......	3	1	......	2	......	......
ear	......	1	1	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	3	3	......	......	......	......
respiratory system	1	32	32	......	1	......	......
digestive system	......	31	29	1	1	......	......
urinary and genital system	......	6	4	......	2	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	17	17	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	1	29	30	......	......	......	......
Total	4	179	173	2	7	......	1

St. Louis, 3d rate, 2d class. Sails; wood; 431 *tons.*

[For the year 1876 was employed as the receiving-ship at League Island. The average number of the ship's company for that period, 109; with a total number sick-days of 891, representing the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	2	17	18		1		
Enthetic		12	12				
Dietic							
Diathetic		10	10				
Developmental							
Tubercular							
Parasitic		1	1				
Of the nervous system		1					1
eye		1	1				
ear							
teeth							
circulatory system							
respiratory system		3	2		1		
digestive system		11	11				
urinary and genital system							
locomotive system							
integumentary system		12	10		2		
Non-malignant tumors and cysts							
Wounds, injuries, and accidents		15	12		1	1	1
Total	2	83	77		5	1	2

Tennessee, 2d rate. Screw; wood; 2,840 *tons.*

[For the year 1876 was employed on the Asiatic station. Average number of ship's company for the year, 420; total sick-days, 10,227, with the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	3	33	29		6		1
Enthetic	14	82	75	1	17		3
Dietic	1	34	35				
Diathetic	3	119	100	2	15		5
Developmental							
Tubercular							
Parasitic		1	1				
Of the nervous system	1	35	31		4		1
eye		6	6				
ear							
teeth		1	1				
circulatory system		16	8	1	7		
respiratory system	3	53	49		7		
digestive system	2	180	177		4		1
urinary and genital system		34	29	1	4		
locomotive system		5	4		1		
integumentary system		96	92		1		3
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	11	125	125		5	1	5
Total	38	820	762	5	71	1	19

Tuscarora, *3d rate. Screw ; wood ; 726 tons.*

[For 258 days of 1876 was employed on the North Pacific station. Average number of crew for that period, 153 + ; with 901 total sick-days, represented by the following diseases :]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	3	3	......	......	......	......
Enthetic	......	17	17	......	......	......	......
Dietic	......	1	1	......	......	......	......
Diathetic	1	9	9	......	1	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	6	6	......	......	......	......
eye	1	......	1	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	1	20	18	......	3	......	......
digestive system	......	8	8	......	......	......	......
urinary and genital system	......	2	2	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	1	19	20	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	25	22	......	3	......	......
Total	4	110	107	......	7	......	......

Tallapoosa, *4th rate. Paddle-wheel ; wood ; 650 tons.*

[For the year 1876 was employed on special service on the Home station. Average number of crew, 100 ; for 275 days of 1876 had a total of 465 sick-days, presenting the following diseases :]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	20	19	......	1	......	......
Enthetic	......	3	2	......	1	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	1	1	......	......	......	......
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	20	14	......	5	1	......
digestive system	......	19	18	......	......	1	......
urinary and genital system	......	......	......	......	......	......	......
locomotive system	......	1	......	......	1	......	......
integumentary system	......	5	4	......	1	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	14	12	......	......	2	......
Total	......	83	70	......	9	4	......

Vandalia, 3d rate. Screw; 981 *tons.*

[For the year 1876 was employed on the European and Home stations. Average crew, 203+; total sick-days, 1,087, presenting the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	19	17	......	2	......	......
Enthetic	......	8	6	......	1	......	1
Dietic	......	1	......	......	1	......	......
Diathetic	......	17	10	......	7	......	......
Developmental	......	1	......	......	1	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	11	8	......	2	......	1
eye	......	4	4	......	......	......	......
ear	......	4	3	......	1	......	......
teeth	......	......	......	......	......	......	......
circulatory system	......	......	......	......	......	......	......
respiratory system	......	21	17	......	4	......	......
digestive system	......	15	14	......	1	......	......
urinary and genital system	......	3	2	......	1	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	4	4	......	......	......	......
Non-malignant tumors and cysts	......	1	1	......	......	......	......
Wounds, injuries, and accidents	......	38	32	4	2	......	......
Total	......	147	118	4	23	......	2

Wyandotte, 4th rate. Screw; iron-clad; 550 *tons.*

[For the 1st and 2d quarters 1876 employed on the Home station. Average crew for that period, 60; total sick-days, 72, representing the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic	......	1	1	......	......	......	......
Enthetic	......	......	......	......	......	......	......
Dietic	......	......	......	......	......	......	......
Diathetic	......	2	1	......	......	......	1
Developmental	......	......	......	......	......	......	......
Tubercular	......	......	......	......	......	......	......
Parasitic	......	......	......	......	......	......	......
Of the nervous system	......	......	......	......	......	......	......
eye	......	......	......	......	......	......	......
ear	......	......	......	......	......	......	......
teeth	......	1	1	......	......	......	......
circulatory system	......	1	......	......	1	......	......
respiratory system	......	5	2	......	3	......	......
digestive system	......	1	......	......	1	......	......
urinary and genital system	......	1	1	......	......	......	......
locomotive system	......	......	......	......	......	......	......
integumentary system	......	1	1	......	......	......	......
Non-malignant tumors and cysts	......	......	......	......	......	......	......
Wounds, injuries, and accidents	......	1	1	......	......	......	......
Total	......	14	8	......	5	......	1

Worcester, 2d rate. Screw; wood; 2,000 *tons.*

[For 84 days in the 1st and 2d quarters 1876 was employed on the Home station. Average crew for that time, 295; total sick-days, 250, representing the following diseases:]

Diseases.	Remaining.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		4	3				1
Enthetic		5	2		2		1
Dietic							
Diathetic		2			2		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		1			1		
eye							
ear							
teeth							
circulatory system		1	1				
respiratory system	1	7	6		2		
digestive system		3	1		2		
urinary and genital system		3	3				
locomotive system							
integumentary system		6	3		2		1
Non-malignant tumors and cysts							
Wounds, injuries, and accidents	1	7	8				
Total	2	39	27		11		3

Yantic, 3d rate. Screw; wood; 410 *tons.*

[For the year 1876 was employed on the Asiatic station Average crew for the year, 124; total sick-days, 2,370, representing the following diseases:]

Diseases.	Remaining for 1875.	Admitted.	Discharged.	Discharged from service.	Transferred.	Died.	Remaining.
Miasmatic		4	4				
Enthetic		32	29	1	2		
Dietic		7	7				
Diathetic		15	7		8		
Developmental							
Tubercular							
Parasitic							
Of the nervous system		4	1		3		
eye		3	3				
ear		2	2				
teeth							
circulatory system		4	2		2		
respiratory system	2	18	14		5	1	
digestive system	1	51	50				2
urinary and genital system	1	12	10		3		
locomotive system		3	1		2		
integumentary system	1	18	16		2		1
Non-malignant tumors and cysts		1	1				
Wounds, injuries, and accidents		24	22	1	1		
Total	5	198	203	2	28	1	3

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, *by the Bureau of Medicine and Surgery.*

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
SALARIES.			
One chief clerk, per act March 3, 1877 (19 Stat. at L., p. 312, sec. 1; Rev. Stats., p. 70, sec. 416)		$1,800 00	
One clerk of class three, per act of March 3, 1877 (19 Stat. at L., p. 312, sec. 1; Rev. Stats., p. 26, sec. 167)		1,600 00	
One messenger, per act March 3, 1877 (19 Stat. at L., p. 312, sec. 1)		840 00	
One laborer, per act March 3, 1877 (19 Stat. at L., p. 312, sec. 1)		720 00	
One clerk of class two (submitted)		1,400 00	
		6,360 00	$4,960 00
CONTINGENT EXPENSES.			
Stationery and miscellaneous items (appropriated, 19 Stat. at L., p. 312, sec. 1)		400 00	
		400 00	100 00
SURGEONS' NECESSARIES AND APPLIANCES.			
For support of the Medical Department of the Navy, for vessels in commission, navy-yards, naval stations, Marine Corps, and Coast Survey (appropriated, 19 Stat. at L., p. 388, sec. 1)		48,000 00	
		48,000 00	30,000 00
REPAIRS AND IMPROVEMENT OF HOSPITALS.			
For repairs to Naval Laboratory, naval hospitals and appendages, including roads, wharves, outhouses, sidewalks, fences, gardens, farms, cemeteries, steam-heating apparatus, furniture, head-marks for graves in cemeteries, &c (appropriated, 19 Stat. at L., p. 388, sec. 1)		51,200 00	
		51,200 00	20,000 00
CONTINGENT.			
For contingent expenses of the bureau; for freight on medical stores; transportation of insane patients; advertising; telegraphing; purchase of books; expenses attending the naval medical examining boards; purchase and repair of wagons and harness; purchase of cows and horses, and feed for same; purchase of trees, seeds, garden-tools, fuel, &c. (appropriated, 19 Stat. at L., p. 389, sec. 1)		25,000 00	
		25,000 00	15,000 00
CIVIL ESTABLISHMENT—NAVAL HOSPITALS AND LABORATORY.			
Naval Hospital, Chelsea, Mass.:			
One purveyor, $750; one apothecary, $480; one engineer, $600	$1,830		
One fireman, $300; one fireman, $150; one gardener, $360	810		
One gate-keeper, $240; three nurses and one mess-room attendant, $240 each	1,200		
One chief cook, $216; one assistant cook, $168; one master-at-arms, $360.	744		
Three washers, at $168 each; four watchmen, at $360 each	1,944		
Two laborers, at $240 each	480		
		7,008 00	
Naval Hospital, New York:			
One purveyor, $750; one apothecary, $480; three nurses, at $240 each	$1,950		
One gardener, $480; one watchman, $420; one watchman, $240	1,140		
One stable-keeper and two firemen, at $480 each; one gate-keeper, $360	1,800		
One mess-man, one laborer, and one chief cook, at $240 each	720		
One assistant mess-man and one assistant cook, at $180 each; one laundress, $216	576		
One washer and two chambermaids, at $168 each	504		
		6,690 00	
Naval Hospital, Philadelphia, Pa.:			
One purveyor, $750; one apothecary, $480; one engineer, $600	$1,830		
One fireman, $300; one carpenter, $480; one gardener, $360	1,140		
One watchman and one mess-room attendant, at $240 each	480		
Three nurses, two laborers, and one chief cook, at $240 each	1,440		
Three washers, at $190 each; one assistant cook, at $168	738		
		5,628 00	
Naval Hospital, Washington, D. C.:			
One purveyor, $750; one apothecary, $480; two firemen, at $360 each	$1,950		
Three nurses and one messenger, at $240 each; two cooks, at $180 each	1,320		
Two laundresses and two laborers, at $144 each; one watchman, $300	876		
One mess-room attendant	180		
		4,326 00	

Estimates of appropriations required for the fiscal year, &c.—Continued.

Detailed objects of expenditure and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
CIVIL ESTABLISHMENT—Continued.			
Naval Hospital, Norfolk, Va.:			
One purveyor, $750; one apothecary, $480; one engineer, $600	$1,830		
One cook and three nurses, at $240 each; one cook, at $180	1,140		
One ambulance-driver and one mess-room attendant, at $180 each	360		
One boatman and two mess-room attendants, at $156 each; one cook, $120	588		
Four laborers, at $150 each; two laundresses, at $96 each	792		
		$4,710 00	
Naval Hospital, Pensacola, Fla.:			
One apothecary, $750; one cook, $240; one nurse and one laborer, at $204 each	$1,398		
One mess-room attendant, $168	168		
		1,566 00	
Naval Hospital, Mare Island, Cal.:			
One purveyor, $1,000; one apothecary and one engineer, at $750 each	$2,500		
One fireman, $360; one chief cook, $540; one assistant cook, $300	1,200		
Three nurses and one gardener, at $420 each; one laborer, $300	1,980		
One watchman, two washers, and one ambulance-driver, at $360 each	1,440		
Two mess-room attendants, at $300 each	600		
		7,720 00	
Naval Hospital, Yokohama, Japan:			
One apothecary, $750; one nurse, $240; one watchman, $216	$1,206		
One cook, $288; one assistant cook, $108; one gardener, 120	516		
Three laborers, at $72 each	288		
		2,010 00	
Naval Academy, Annapolis, Md.:			
One apothecary, $750; one nurse, $240; two laborers, at $180 each	$1,350		
One watchman (for duty at hospital), $730	730		
		2,080 00	
Naval Laboratory, New York:			
One clerk, one manufacturer, and one carpenter, at $700 each	$2,100		
One engineer and one chief packer, at $660 each; one fireman, $300	1,620		
One shipping-porter, $504; two assistant packers, $300 each	1,104		
		4,824 00	
Navy-yard, Portsmouth, N. H.:			
One apothecary, $750; one cook, $240; one nurse, $240	1,230		
One watchman	730		
		1,960 00	
Navy-yard, Boston, Mass.:			
One apothecary, $750; one laborer, $548		1,298 00	
Navy-yard, New York:			
One apothecary, $750; one laborer, $548		1,298 00	
Navy-yard, Philadelphia:			
One apothecary, $750; one laborer, $548		1,298 00	
Navy-yard, Washington, D. C.:			
One apothecary, $750; one laborer, $548		1,298 00	
Navy-yard, Norfolk, Va.:			
One apothecary, $750; one laborer, $548		1,298 00	
Navy-yard, Pensacola, Fla.:			
One apothecary, $750; one laborer, $548		1,298 00	
Navy-yard, Mare Island, Cal.:			
One apothecary, $1,000; one laborer, $730 (appropriated; 19 Stat. at L., p. 389, sec. 1)		1,730 00	
		58,040 00	25,000 00
NAVAL HOSPITAL FUND.			
For maintenance of the naval hospitals, Portsmouth, N. H., Chelsea, Mass., Brooklyn, N. Y., Philadelphia, Pa., Annapolis, Md., Washington, D. C., Norfolk, Va., Pensacola, Fla., Mare Island, Cal., and Yokohama, Japan (submitted)		100,000 00	
RECAPITULATION.			
Surgeons' necessaries and appliances		48,000 00	30,000 00
Repairs and improvements of hospitals		51,200 00	20,000 00
Contingent		25,000 00	15,000 00
Civil establishment		58,040 00	25,000 00
Naval-hospital fund		100,000 00	
		282,240 00	90,000 00

Respectfully submitted.

W. GRIER,
Surgeon-General, United States Navy.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1877, by the Bureau of Medicine and Surgery.

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year, ending June 30, 1877.
DEFICIENCIES.		
SURGEONS' NECESSARIES AND APPLIANCES.		
For amount due from the appropriation, surgeons' necessaries and appliances, for the fiscal years ending June 30, 1875, 1876, and 1877, to the naval-hospital fund, for medicines and medical stores furnished vessels in commission, navy-yards, naval stations, Marine Corps, and Coast Survey (appropriated)	$52,985 17	$30,000 00

Respectfully submitted.

W. GRIER,
Surgeon-General, United States Navy.

No. 8—BUREAU OF PROVISIONS AND CLOTHING.

BUREAU OF PROVISIONS AND CLOTHING,
October 25, 1877.

SIR: In accordance with instructions contained in your letter of the 10th instant, I have the honor to submit, herewith, estimates, marked A, B, C, D, E, and F, for the fiscal year ending June 30, 1879; also, estimate of deficiency for the fiscal year 1877–'78, marked E^2, and estimates of deficiencies for the fiscal year 1876–'77, marked A^2, B^2, C^2, and D^2; together with schedules numbered 1 to 6, inclusive, and statement numbered 7, pertaining to the operations of this bureau during the year ending June 30, 1877.

It is respectfully recommended that Congress be asked to make a special appropriation of $50,000, for the purpose of building houses in the various navy-yards for the use of the pay-officers of the Navy, as the present accommodations are found to be insufficient. It is believed that pay-officers require the erection of these buildings for the more convenient transaction of business, and the better security of funds placed in their hands.

I desire to renew my recommendation that a credit of three months' pay be given to each enlisted man, when he shall have been shipped three months, as a more effectual means of preventing desertions than an outfit to each man at the time of shipment, as recommended by several of my predecessors.

I also renew my recommendation that appointments to the Paymasters' Corps of the Navy be made from graduates from the United States Naval Academy, as a measure calculated to obviate difficulties arising from assimilated rank, and to promote the general efficiency of the service.

I desire to call especial attention to the act of Congress of March 3, 1871, providing for the promotion of assistant surgeons to the rank and pay of passed assistant surgeons after three years' service, as working an injustice to the Pay Corps of the Navy.

By reference to the Navy Register it will be seen that the first nine assistant paymasters were appointed in 1870, while there are passed assistant surgeons who did not enter the service as assistants until 1874, and who are given priority in rank, with the accompanying precedence in quarters on board ship, and increased pay, by their promotion.

The existing inequality will increase from year to year, and assistant paymasters may be fifteen years before promotion, while assistant surgeons are eligible for promotion after three years' service.

Attention is respectfully called to the unequal working of the law as it now exists, and it is most earnestly recommended that Congress be asked to amend the same, by providing that assistant paymasters, after three years' service, shall be promoted to the grade of passed assistant paymaster.

Very respectfully, your obedient servant,

JAS. H. WATMOUGH,
Paymaster-General, U. S. Navy.

Hon. R. W. THOMPSON,
Secretary of the Navy.

Statement showing the indebtedness of and the amounts due the Bureau of Provisions and Clothing, June 30, 1877.

	Provisions.	Clothing.	Pay.	Contingent.
Amount of bills unpaid	$55, 846 31	$385, 189 08	$28, 500 00	....
Due the various bureaus of the Navy Department	37 07	....	....	....
Due "Pay of the Navy" on account of purchases and expenses of storehouses abroad	225, 742 77	3, 489 05	....	$4, 548 30
Due "Hospital Fund"	4, 909 89	....	....	....
Due on account of freight to foreign stations	....	....	....	3, 935 91
Total	286, 536 04	388, 678 13	28, 500 00	8, 484 21
Amounts due Bureau Provisions and Clothing from other bureaus	3, 887 65	1, 114 71	....	2, 077 70
Amount due "Clothing" on account of clothing issued and checked against appropriation "Pay"	....	339, 200 23	....	....
Due the Bureau Provisions and Clothing from Marine Corps	1, 699 74	....	....	....
Total	5, 587 39	340, 314 94	....	2, 077 70
July 1, 1877, balance indebtedness of bureau	280, 948 65	48, 363 19	28, 500 00	6, 406 51

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, *by the Bureau of Provisions and Clothing.*

Detailed object of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
A.—EXPENSES OF THE BUREAU OF PROVISIONS AND CLOTHING.		
For salary of chief clerk, per act July 5, 1862 (12 Stat. at L., p. 511, sec. 3)	$1, 800 00	
For salary of one clerk of class four, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	1, 800 00	
For salary of two clerks of class three, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	3, 200 00	
For salary of one clerk of class three (submitted)	1, 600 00	
For salary of two clerks of class two, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	2, 800 00	

Estimates of appropriations required for the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
A.—Expenses of the Bureau of Provisions and Clothing—Continued.		
For salary of three clerks of class one, per act July 23, 1866 (14 Stat. at L., p. 208, sec. 8)	$3,600 00	
For salary of messenger, per act July 5, 1862 (12 Stat. at L., p. 511, sec. 3)	840 00	
For salary of one laborer, per act July 12, 1870 (16 Stat. at L., p. 250, sec. 3)	720 00	
	16,360 00	$14,760 00
NOTE.—The estimate for an additional clerk of class three is submitted; and if this be allowed the bureau would recommend that one clerk of class two and one clerk of class one be dispensed with, thus making the total appropriation only $13,760, or $1,000 *less* than that of last year.		
B.—Contingent expenses of the bureau.		
For blank-books, stationery, and miscellaneous items (appropriated; 19 Stat. at L., p. 312)	800 00	400 00
C.—Provisions for the Navy.		
To pay 1,100 officers for commuted rations, they being on duty and entitled to the same, at 30 cents per diem (appropriated)	120,450 00	
To pay 1,500 men for commuted rations (that being one-fifth of the number of men allowed), at 30 cents per diem (appropriated)	164,250 00	
For the purchase of rations for 6,000 men (that being four-fifths of the number of men allowed), at 30 cents per diem (appropriated)	657,000 00	
For 10 per cent. on above amount for waste in handling and issuing provisions, and losses by condemnation (appropriated)	65,700 00	
To pay 200 marines for commuted rations (that being one-fifth of the number on duty entitling them to a ration), at 30 cents per diem (appropriated)	21,900 00	
For the purchase of rations for 800 marines (that being four-fifths of the number on duty entitling them to a ration), at 30 cents per diem (appropriated)	87,600 00	
For 10 per cent. on above amount, for waste in handling and issuing provisions, and losses by condemnation (appropriated)	8,760 00	
To pay expenses of nine inspections in the United States, including labor, and three storehouses abroad, including labor and rent (appropriated; 19 Stat. at L., p. 389	100,000 00	
	1,225,660 00	930,000 00
For the purchase of water for ships (appropriated; 19 Stat. at L., p. 389)	30,000 00	25,000 00
NOTE.—In submitting this estimate the bureau respectfully refers to its deficiency estimate for the fiscal year 1876–'77, an examination of which will show that a less sum than that herein asked for will be insufficient to meet the demands upon the bureau.		
D.—Contingent expenses of the Navy under Bureau of Provisions and Clothing.		
For freight charges on shipments	30,000 00	
For candles	25,000 00	
For fuel	1,000 00	
For books and blanks	2,000 00	
For stationery	9,000 00	
For advertising and commissions on sales	1,500 00	
For postage, telegrams, and express charges	500 00	
For tolls, ferriage, and car-tickets	300 00	
For yeoman's stores	3,000 00	
For iron safes	2,000 00	
For newspapers, ice, and other expenses not enumerated (appropriated, 19 Stats. at L., p. 389)	700 00	
	75,000 00	35,000 00
NOTE.—Prior to the fiscal year 1874–'75, the annual appropriation under "Contingent," Bureau of Provisions and Clothing, was $75,000, and it is found by experience that a smaller sum than this is inadequate to the wants of the service. The comparatively small deficiency under this head from the reduced appropriation of last year is owing to the fact that the full supplies of stores on foreign stations at the commencement of the year rendered but few shipments necessary; but it is probable that shipments to most of them will be required during the present year.		

Estimates of appropriations required for the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
E.—SMALL STORES FOR THE NAVY.		
For the purchase of small stores (submitted)	$75,000 00	
F.—CIVIL ESTABLISHMENT.		
Navy-yard, Boston, Mass.:		
One writer to paymaster	1,017 25	
One writer to inspector	1,017 25	
Navy-yard, New York, N. Y.:		
One assistant inspector	1,400 00	
One writer to inspector	1,017 25	
One writer to paymaster	1,017 25	
One writer to paymaster	939 00	
Navy-yard, League Island, Pa.:		
One writer to paymaster	1,017 25	
Navy-yard, Washington, D. C.:		
One writer to paymaster	1,017 25	
Navy-yard, Norfolk, Va.:		
One writer to paymaster	1,017 25	
One writer to inspector	1,017 25	
Navy-yard, Mare Island, Cal.:		
One writer to paymaster	1,017 25	
One writer to inspector (submitted, 17 Stats. at L., p. 552, sec. 1)	1,017 25	
	12,511 50	$14,285 60
NOTE.—Since the fiscal year ending June 30, 1874, the appropriations for "Civil Establishment" have been made in gross for the entire Navy Department, instead of for each bureau separately, as was done prior to that year.		

Estimates of appropriations required for the service of the fiscal year ending June 30, 1878, by the Bureau of Provisions and Clothing.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
DEFICIENCIES.		
E².—PROVISIONS.		
For the payment of commuted rations, pay of labor, purchase of provisions and water, &c., being the difference between the estimate and the appropriation for the year (submitted)	$298,721 85	
NOTE.—In submitting this estimate, the bureau respectfully refers to its deficiency estimate for the fiscal year 1876-'77, an examination of which will show that a less sum than that herein asked for will be insufficient to meet the demands upon the bureau. It would also add that, it having become generally known that the appropriations are insufficient, an increased price has to be paid for articles purchased. The reservation bills for stores delivered in July, 1876, have not been paid, and cannot be until an appropriation shall have been made; the contractor thus having to wait not less than fifteen months for his pay after the delivery of stores.		

Estimates of appropriations required for the service of the fiscal year ending June 30, 1877, *by the Bureau of Provisions and Clothing.*

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1877.
DEFICIENCIES.		
A².—PROVISIONS.		
To pay officers, crew, and marines commuted rations; and to reimburse "Pay of the Navy" for expenditures under "Provisions" from "Pay of the Navy," by pay-officers of ships (submitted)	$226,242 42	
To pay Bureau of Medicine and Surgery commuted rations of sick in hospitals (submitted)	16,035 55	
To pay for provisions purchased and delivered during the fiscal year (submitted)	55,846 31	
	298,124 28	
NOTE.—All the returns for the three quarters ended March 31, 1877, have been received and settled; and the above estimate is based upon the same ratio of expenditure for the fourth quarter. During the three quarters $463,831.82 was paid by paymasters abroad for commuted rations and the purchase of provisions, from the appropriation "Pay of the Navy"; $62,186.00 has been drawn from the bureau for payment of commuted rations, and $51,027 for payment of labor in the inspections of provisions and clothing in the United States; leaving $477,955.18 for the purchase of provisions in the United States by the bureau. The daily average number of officers to whom commutation of rations has been paid is 1,079; the daily average number of marines rationed, 1,026.		
B².—CLOTHING.		
To reimburse "Pay of the Navy" for expenditures under "Clothing" from "Pay of the Navy," by pay-officers of ships (submitted)	3,489 05	
To pay bills for clothing purchased and delivered during the fiscal year 1876–'77, and previous years (submitted)	396,866 64	
	400,355 69	
NOTE.—There is due from "Pay" to "Clothing," for cost of clothing issued to officers, crew, and marines, to March 31, 1877, the sum of $281,847.37; estimate for the quarter ending June 30, 1877, $75,000; making $356,847.37 due "Clothing," July 1, 1877.		
C².—SMALL STORES. (Appropriation "Pay of the Navy.")		
To pay for tobacco purchased and delivered during the fiscal year (submitted).	28,500 00	
D².—CONTINGENT.		
To reimburse "Pay of the Navy" for expenditures under "Contingent of Bureau" from "Pay of the Navy," by pay-officers of ships (submitted)	4,241 75	
To pay freight on stores to foreign stations (submitted)	3,935 91	
	8,177 66	

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Portsmouth, N. H., during the fiscal year* 1877–'78.

Name.	Fresh bread.	Fresh beef.	Vegetables.
	Per pound.	*Per pound.*	*Per pound.*
J. Stokell & Co *	$0 06	$0 08	$0 01½
J. E. Chase	06½	08 28/100	01 28/100

* Contracts awarded.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Boston, Mass., during the fiscal year* 1877–'78.

Name.	Baking bread.	Fresh bread.	Fresh beef.	Vegetables.
	Per barrel of flour.	*Per pound.*	*Per pound.*	*Per pound.*
C. F. Austin & Co.*	$1 75	$0 06⅛		
J. W. Hobbs*			$0 11⅛	$0 02⅛
C. Flanders			12	02⅛

* Contracts awarded.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at New York during the fiscal year* 1877–'78.

Name.	100,000 pounds sugar.	Baking bread.	Fresh bread.	500 barrels Navy beef.	Fresh beef.	Vegetables.
	Per pound.	*Per barrel of flour.*	*Per pound.*	*Per barrel.*	*Per pound.*	*Per pound.*
W. F. Turner				$19 00		
J. W. McCulloh				16 40		
William Mathews				17 35		
Halstead & Co				16 43		
William Mathews*	$0 10$\frac{27}{100}$					
H. K. Thurber & Co	11					
J. W. Motley	11$\frac{48}{100}$					
Henry Adams	11$\frac{30}{100}$					
E. Treadwell & Son		$1 49				
C. T. Goodwin & Sons*		1 00				
John Hanley*					$0 13⅞	$0 03⅛
J. Lancaster					14½	04⅜
L. J. Tormey					14⅞	04⅝
J. McNamara*			$0 05⅛			

* Contracts awarded.

Proposals for Navy beef not accepted.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at League Island, Pa., during the fiscal year* 1877–'78.

Name.	Baking bread.	Fresh bread.	Fresh beef.	Vegetables.
	Per barrel of flour.	*Per pound.*	*Per pound.*	*Per pound.*
J. S. Ivins & Son*	$1 44			
H. H. Corney			$0 11⅞	$0 03⅛
L. S. Boraef*		$0 06	10⅜	03⅜

* Contracts awarded.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Washington, D. C., during the fiscal year* 1877–'78.

Name.	Fresh bread.	Fresh beef.	Vegetables.
	Per pound.	*Per pound.*	*Per pound.*
J. T. Varnell	$0 04⅛	$0 05⅜	$0 03⅛
J. G. Carroll*		06	02$\frac{9}{16}$
M. H. Homiller	05	07$\frac{3}{16}$	03
George Seits & Son*	04⅛		

*Contracts awarded.

The bid of J. T. Varnell, for fresh bread, was withdrawn in favor of George W. Seits & Son.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Norfolk and Hampton Roads, Va., during the fiscal year* 1877–'78.

Name.	Baking bread.	Fresh bread.	Water.	Fresh beef.	Vegetables.
	Per barrel of flour.	*Per pound.*	*Per gallon.*	*Per pound.*	*Per pound.*
R. Searls				$0 08 48/100	$0 02¼
J. G. Codd				08 19/100	02 49/100
Kimberly Bros				08 74/100	02 84/100
F. Dusch				08	02
J. Gutman				09	03½
S. Westheimer				07½	02½
J. E. Baum *				07 49/100	02
J. Reid & Co	*$1 75	$0 06			
C. F. Cabler *		05⅝			
B. W. Baker *			†$0 00½		
Do *			‡00⅝		
J. Baker			00 48/100		
C. W. Clark			†00⅝		
Do			‡00¾		

* Contracts awarded. † For delivery at Norfolk. ‡ For delivery at Hampton Roads.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Port Royal, S. C., during the fiscal year* 1877–'78.

Name.	Water.	Fresh bread.	Fresh beef.	Vegetables.
	Per gallon.	*Per pound.*	*Per pound.*	*Per pound.*
H. F. Turner			$0 15	$0 05
Benjamin Burr *			12 48/100	03
James Odell *		$0 06		
Dick & Small *	$0 01¼			

* Contracts awarded.

NOTE.—The above-mentioned supplies to be delivered to the vessels lying off Port Royal by the contractors, when required, without extra charge.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Key West, Fla., during the fiscal year* 1877–'78.

Name.	Navy bread.	Fresh beef.	Vegetables.
	Per pound.	*Per pound.*	*Per pound.*
I. J. Philbrick *		$0 11	$0 05
Lazo & McClennan		12½	05
George W. Maslin *	$0 06½		

* Contracts awarded.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Pensacola, Fla., during the year* 1877–'78.

Name.	Fresh bread.	Navy bread.	Fresh beef.	Vegetables.
	Per pound.	*Per pound.*	*Per pound.*	*Per pound.*
James Murphy *			$0 09½	$0 05
J. S. Bell			10½	04½
J. O'Neal *		$0 05½		
H. McKenzie *	$0 06			
Moses White	06½			

* Contracts awarded.

Schedule of proposals received during the fiscal year ending June 30, 1877, *for supplies to be delivered at Mare Island, Cal., during the fiscal year* 1877-'78.

Name.	Fresh bread.	Navy bread.	Fresh beef.	Vegetables.
	Per pound.	*Per pound.*	*Per pound.*	*Per pound.*
J. F. Tobin*	$0 04¼		$0 07	$0 03⅓
A. Newman			07$\frac{9}{10}$	03$\frac{9}{10}$
San Francisco Cracker Company		$0 04⅓		
California Cracker Company*		03$\frac{6}{10}$		

* Contracts awarded.

Statement of contracts made by the Bureau of Provisions and Clothing, for and in behalf of the Navy Department, during the fiscal year ending June 30, 1877.

Name.	Date.	Articles contracted for.	Price.	Where to be delivered.
	1877.			
J. E. Baum	June 25	Fresh beef ... per lb.	$0 07$\frac{42}{100}$	Norfolk, Va.
Do	June 25	Vegetables ... do	02	Do.
B. W. Baker	June 25	Water ... per gall.	00¼	Do.
Do	June 25	... do ... do	00⅛	Hampton Roads.
C. T. Cabler	June 25	Fresh bread ... per lb.	05⅝	Norfolk, Va.
J. G. Carroll	June 27	Fresh beef ... do	06	Washington, D. C.
Do	June 27	Vegetables ... do	02$\frac{4}{10}$	Do.
L. S. Boraef	June 28	Fresh beef ... do	10¾	League Island, Pa.
Do	June 28	Vegetables ... do	03¼	Do.
Do	June 28	Fresh bread ... do	06	Do.
John Hanley	June 29	Fresh beef ... do	13⅜	New York, N. Y.
Do	June 29	Vegetables ... do	03½	Do.
William Mathews	June 29	100,000 pounds sugar ... do	10$\frac{27}{100}$	Do.
J. McNamara	June 29	Fresh bread ... do	05⅝	Do.
J. S. Ivins & Sons	June 29	Baking bread ... per bbl. of flour.	1 44	League Island, Pa.
C. F. Austin & Co	June 30	... do ... do	1 75	Boston, Mass.
Do	June 30	Fresh bread ... per lb	06½	Do.
C. T. Goodwin & Sons	June 30	Baking bread ... per bbl. of flour.	1 00	New York, N. Y.
G. Seitz & Son	June 30	Fresh bread ... per lb	04½	Washington, D. C.
J. W. Hobbs	June 30	Fresh beef ... do	11⅛	Boston, Mass.
Do	June 30	Vegetables ... do	02½	Do.

NOTE.—The above-mentioned supplies to be delivered as required during the fiscal year 1877-'78.

No. 9.—BUREAU OF STEAM-ENGINEERING.

NAVY DEPARTMENT,
BUREAU OF STEAM-ENGINEERING,
Washington, November 9, 1877.

SIR: I have the honor to submit to the department the annual report of the operations of this bureau.

On the 3d of March, 1877, I received my commission as Chief of this bureau, and on assuming its duties, found the departments under its cognizance at the several navy-yards nominally closed. This course had been rendered necessary in consequence of the small balance of appropriation for fiscal year 1876-'77 remaining to the credit of the bureau, namely, $36,291.07. With this amount nothing could be done, except to maintain, as far as possible, a partial organization at the several navy-yards, and to preserve the machinery, tools, &c., from deterioration.

In obedience to your order, I had the honor to submit to you, on the 15th of March, tabulated exhibits, giving a complete and comprehensive statement of the financial condition of the bureau at that date for all purposes, showing a total indebtedness of $2,995,835.48. Of this amount, $1,165,000 was for contracts made March 3, 1877, and $331,621.09 were for contracts made March 7. These contracts were subsequently suspended by your order.

NAVY-YARDS.

The departments under the cognizance of this bureau in the several navy-yards are, with two or three exceptions (Pensacola, Norfolk, and Boston), in excellent working condition. Your attention has been called to the necessities of these yards in special reports, accompanied with drawings showing the proposed improvements and additions, and, for the reasons assigned in my former communications, I would again urge their importance upon your consideration.

The following will exhibit the extent and character of the work done by this bureau upon the machinery, boilers, &c., of naval steamers during the past year, the work now being done, and the work necessary to be done to repair and refit machinery, &c., for efficient service.

Colorado (1st rate).—New boilers have been completed by C. H. Delamater & Co., New York, and have been delivered at the Brooklyn navy-yard. Machinery, &c., will require minor repairs for present duty, and general overhauling and repairs if ordered for sea-service.

Franklin (1st rate).—New boilers are in an advanced state toward completion by John Roach, New York. Machinery, &c., will require minor repairs for preservation and present duty, and general overhauling and repair if ordered for sea-service.

Wabash (1st rate).—New boilers are being constructed by John Roach, New York. Machinery, &c., require small repairs for preservation and present duty, and *new* machinery if ordered for sea-service.

Iowa (2d rate).—Boilers being removed and refitted for use on other vessels.

Tennessee, (2d rate).—Machinery, &c., require some repairs and readjustments when the vessel has completed her present cruise.

Lancaster (2d rate).—The new boilers completed by the Providence Steam-Engine Company have been delivered at the Portsmouth, N. H., navy-yard. When the vessel is rebuilt, the machinery will require general overhauling, repair, and re-erection.

Brooklyn (2d rate).—New boilers have been constructed by John Roach and delivered in the Brooklyn navy-yard. Machinery, &c., has been ordered to be repaired in the Brooklyn navy-yard.

Pensacola (2d rate).—Machinery, &c., undergoing considerable repair at Mare Island navy-yard for temporary service. Will require extensive repairs and new boilers.

Hartford (2d rate).—New boilers have been constructed by the South Boston Iron Company, and delivered in the Boston navy-yard. Machinery, &c., require temporary repairs for present duty.

Richmond (2d rate).—New boilers nearly completed by the Providence Steam-Engine Company. Machinery, &c., undergoing extensive repairs at the Boston navy-yard.

Trenton (2d rate).—Has been fitted for sea, and is now on the European station as flag-ship. Machinery, &c., require usual repairs and readjustments.

Alaska (2d rate).—New boilers, constructed by Quintard Iron-Works, have been completed and delivered at the Brooklyn navy-yard, and are now being being placed on board the vessel. Machinery, &c., undergoing thorough repair, and a new four-bladed screw propeller is to be fitted in place of the two bladed propeller.

Benicia (2d rate).—New boilers, made by Quintard Iron-Works, have been completed and delivered at the Brooklyn navy-yard. These boilers have been shipped to the Mare Island navy-yard, where they will be placed on board the vessel when they arrive. Machinery, &c., is being thoroughly repaired.

Omaha (2d rate).—New boilers are partially completed by the Providence Steam-Engine Company. The engines require extensive repairs. A new four-bladed screw propeller is to be fitted in place of the present two-bladed propeller when the repairs are made.

Plymouth (2d rate).—Engines, &c., require thorough repairs and new boilers made and placed in the vessel. When the repairs are made, a new four-bladed screw propeller will be fitted in place of the present two-bladed propeller.

Lackawanna (2d rate).—Engines, &c., require considerable repairs and new boilers are to be placed on board.

Ticonderoga (2d rate).—Undergoing extensive repairs at the Portsmouth, N. H., navy-yard. The present two-bladed propeller is to be replaced by the original four-bladed propeller.

Canandaigua (2d rate).—Machinery, &c., undergoing extensive repairs at the Norfolk navy-yard. The present two-bladed propeller is to be replaced by a new four-bladed propeller.

Shenandoah (2d rate).—New boilers have been made by the South Boston Iron Company and delivered at the Boston navy-yard. Machinery, &c., require thorough overhauling and repair and new boilers placed on board the vessel.

Juniata (3d rate).—Machinery, &c., require very extensive repairs and the new boilers now completed to be placed on board the vessel.

Ossipee (3d rate).—Machinery, &c., require small repairs for present duty.

Quinnebaug (3d rate).—The work of erecting the machinery, boilers, &c., by Messrs. Neafie & Levy, has been completed, and a satisfactory steam-trial has been made at the dock, and the ship will be fitted for sea at an early date.

Galena (3d rate).—But little progress has been made upon the compound machinery for this vessel at the Norfolk navy-yard, but the work is again fairly in hand and progressing favorably.

Mohican (3d rate).—But little progress has been made upon the compound machinery for this vessel at the Mare Island navy-yard, but the work is again fairly in hand and progressing favorably.

Iroquois (3d rate).—Requires extensive repairs to machinery and new boilers to be made.

Wachusett (3d rate).—Machinery, &c., undergoing thorough repairs at the Boston navy-yard; new boilers are being placed on board, and the present two-bladed propeller is to be replaced by the original four-bladed propeller.

Tuscarora (3d rate).—Machinery, &c., undergoing thorough repairs at the Mare Island navy-yard. Contract for new boilers was made with the South Boston Iron Company March 7, 1877, and subsequently suspended by your order.

Kearsarge (3d rate).—New boilers have been completed by the Providence Steam-Engine Company, and are now being delivered at the Boston navy-yard. Machinery, &c., require extensive repairs and the new boilers placed on board the vessel.

Nipsic (3d rate).—New compound engines are at the Washington navy-yard ready for erection on board; new boilers are being made in same yard.

Narragansett (3d rate).—Machinery. &c., require very extensive repairs. Contract for new boilers was made with the South Boston Iron Company March 7, 1877, and subsequently suspended by your order.

Huron (3d rate).—A new iron four-bladed propeller, of bureau design, has been fitted in place of the original Hirsch four-bladed propeller, and a trial made with the most satisfactory results, giving a speed of vessel under full power of ten knots; an increase of over two knots an hour. The power of the propeller to back the vessel has been satisfactorily tested. When the ship was going at full speed ahead the order was given to back the engines. and the ship was going astern in one minute and fifteen seconds. From a state of rest, the vessel was moving astern in fifteen seconds.

Yantic (3d rate).—New boilers were constructed and delivered by the Providence Steam-Engine Company, and the machinery, &c., are awaiting repairs at the Washington navy-yard, including erection of new boilers on board vessel.

Michigan (3d rate).—Machinery, &c., require considerable repairs.

Frolic (4th rate).—Machinery, &c., require overhauling and repair when the vessel is required for service.

Tallapoosa (4th rate).—New paddle-wheels have been fitted, and small repairs to machinery, &c., made.

Amphitrite (iron-clad, 3d rate).—New boilers are well advanced toward completion at the works of the Harlan & Hollingsworth Company, Wilmington, Del. New engines for the vessel were contracted for with the Harlan & Hollingsworth Company March 3, 1877, and the contract was subsequently suspended by your order.

Camanche (iron-clad, 4th rate).—The boilers which were refitted for this vessel are being connected on board, and minor repairs are being made to the machinery.

Dictator (iron-clad, 2d rate).—Machinery, &c., needs extensive repairs. Contract for new boilers was made with South Boston Iron Company, March 10, 1877, and subsequently suspended by your order.

Miantonomoh (iron-clad, 3d rate).—The new twin compound engines, &c., are nearly completed at the works of John Roach, Chester, Pa.

Monadnock (iron-clad, 3d rate).—The new boilers built by T. F. Rowland, Greenpoint, N. Y., have been tested by a board of naval engineers preparatory to being delivered at the Brooklyn navy-yard. New engines for the vessel were contracted for with Phineas Burgess March 3, 1877, and subsequently suspended by your order.

Saugus (iron-clad, 4th rate).—Minor repairs are required to engines and boilers.

Puritan (iron-clad, 2d rate).—New boilers, constructed by John Roach, Chester, Pa., are nearly completed. New engines for the vessel were contracted for with John Roach March 3, 1877, and subsequently suspended by your order.

Terror (iron-clad, 3d rate).—New boilers being made by William Cramp & Sons are well advanced toward completion. New engines were contracted for with William Cramp & Sons March 3, 1877, and subsequently suspended by your order.

Emerald (tug).—Machinery has been thoroughly repaired, and new boiler made and placed on board the vessel at Portsmouth, N. H., navy-yard.

Leyden (tug).—Undergoing thorough repair, and new boilers are being placed and connected on board the vessel at the Boston navy-yard.

Pinta (tug).—Engines, boilers, &c., have been repaired at the Norfolk navy-yard.

Rocket (tug).—Thorough repairs to machinery, boiler, &c, have been completed at the Brooklyn navy-yard.

Snowdrop (tug).—Machinery, &c., requires extensive repairs. Contract for new boilers was made with the South Boston Iron Company, March 7, 1877, and subsequently suspended by your order.

Standish (tug).—Machinery, &c., requires extensive repairs and new boilers.

Triana (tug).—Machinery, &c., undergoing thorough repair, and new boilers are to be placed on board the vessel at the Washington navy-yard.

STEAM-MACHINERY FOR STEERING SHIPS, LIFTING ANCHORS, ETC.

The experience of foreign navies, and as well also that of the mercantile marine, shows fully the very great economy in time and labor resulting from the introduction of steam steering apparatus, windlasses, and capstans. We have at this time one or two of our naval ships supplied with steam steering machinery with very satisfactory results, and, with a view to their general introduction, a board of experienced engineer officers are now engaged in examining the most approved plans, to report upon those best adapted to the naval service.

IRON-SHIP BUILDING.

This great and growing interest, so rapidly being developed in this country, and opening additional avenues for the utilization of our coal and iron, and the education of skilled labor in that particular branch of marine engineering industry, in building up and organizing civil establishments upon which the government can call in cases of great emergencies, for the construction of its iron ships of war, cannot be overestimated. The introduction of iron in the construction of ships for the mercantile marine, as well as for naval purposes, requires that, in addition to their present practical knowledge on the subject of construction, the engineer officers of the Navy should be thoroughly versed in the theory and practice of naval architecture.

To this end, and in furtherance of this view, the following circular-letter was issued from this bureau, in September last, to the engineer officers of the Navy:

NAVY DEPARTMENT,
BUREAU OF STEAM-ENGINEERING,
Washington, September 4, 1877.

SIR: Section 1403 of the Revised Statutes provides that officers of the engineer corps may be appointed assistant naval constructors; and it is most desirable that the corps, of which you are a member, should at all times be prepared for an extension of its usefulness; it is therefore urgently recommended that in your course of scientific studies you devote more time and attention to the subject of naval architecture than heretofore, in order to fit yourself for superintending the designing and constructing of iron ships of war.

W. H. SHOCK,
Chief of Bureau.

I would, in addition to this, respectfully recommend that, if practicable, more time be devoted at the Naval Academy to this particular branch of marine engineering.

PLATE-IRON FOR BOILERS.

I would respectfully urge upon the department the necessity of a law authorizing the purchase of plate-iron for steam-boilers, wherever it can be obtained of the proper quality.

The practice (in obedience to law) of purchasing by advertisement and from lowest bidder, entails a serious expense and delay in testing the samples of material proposed to be furnished, which, in the end, often proves utterly worthless. The authority to purchase direct from makers of known reputation their best qualities of boiler-iron, at its market value, would insure good material, and avoid these delays.

As an example of these vexatious delays I would state: On the 10th of July last this bureau advertised for proposals for boiler-iron, to be delivered in the Washington and Norfolk navy-yards on or before October 1. Specimens of the iron proposed for the delivery under this advertisement were furnished for examination and test, by the two lowest bidders, and have failed to come up to the requirements, consequently the contract for the iron has not *yet* been closed. It is quite probable that the requisite quality of iron cannot be furnished for the prices bid, which will probably cause further delay and expense, in going through the same forms of advertising and test, and may not be obtained even then.

PROCEEDS OF PUBLIC SALES.

I would also respectfully ask that Congress may be requested to amend the law in relation to proceeds of public sales, so as to allow all the expenses of said sales, such as advertising, auction fees, &c., to be deducted from the proceeds of such sales, and the balance covered into the Treasury. With the law as it now stands (section 3618 Revised Statutes) these expenses are paid from our regular appropriations, and the appropriation gets no credit therefor.

ESTIMATES.

I have the honor to submit herewith the annual estimates of this bureau for the fiscal year ending June 30, 1879; and it is proper to state that I have carefully examined and revised these estimates, and am of the opinion that they are the very lowest amounts practicable for meeting the demands upon this bureau for all matters under its cognizance for said fiscal year.

I have the honor to be, very respectfully, your obedient servant,

W. H. SHOCK,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

Statement of indebtedness—Bureau of Steam-Engineering, Navy Department.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.
STEAM MACHINERY.		
To pay approved bills (see sheets marked A)	$1,056,458 04	
To pay claims for which bills have not yet been approved (see sheet marked B)	57,364 76	
To pay balances under existing contracts (see sheet marked C)	545,092 66	
To complete suspended contracts (see sheet marked D)	1,505,000 00	
		$3,163,915 46

A.

Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.
	STEAM MACHINERY.		
	To pay approved bills.		
Mar. 10, 1877	American Tube Works, bushings	$46 75	
Jan. 17, 1877	American Steam Gauge Company, spring	11 50	
Apr. 14, 1877	American Steam Gauge Company, repairs	9 00	
Feb. 28, 1877	E. H. Ashcroft, valves for Ranger	625 00	
Mar. 22, 1877	William H. Arthur & Co., stationery	22 25	
Mar. 22, 1877	......do	35 00	
Apr. 7, 1877	......do	135 05	
Feb. 1, 1877	Atlantic Works, work on Adams	75 86	
Feb. 1, 1877	Atlantic Works, work on Essex	308 08	
Feb. 17, 1877	Atlantic Works, expenses of trial of Essex	1,029 50	
June 18, 1877	Adams Express Company, freight	2 35	
July 16, 1877	Stillman B. Allen, governors	450 00	
Apr. 19, 1877	A. P. Brown, stores	42,099 06	
Apr. 19, 1877	..... do	7,121 55	
Apr. 19, 1877	A. P. Brown, lumber	1,283 33	
Feb. 26, 1877	D. Babcock & Co., stores	5,498 32	
Mar. 17, 1877	D. Babcock & Co., drills	82 50	
Mar. 17, 1877	D. Babcock & Co., stores	147 74	
Mar. 17, 1877	......do	33 15	
Mar. 17, 1877	......do	91 55	
Mar. 22, 1877	......do	221 15	
Feb. 28, 1877	Boston Lead Company, lead	95 00	
Apr. 13, 1877	George F. Blake Manufacturing Company, pump	225 00	
May 21, 1877	Bemer & Pinckney, freight	26 05	
Feb. 28, 1877	Cook, Rymes & Co., grate	14 00	
Mar. 12, 1877	Chalmers Spence Company, leading Swatara boilers	274 23	
Mar. 12, 1877	Chalmers Spence Company, covering Swatara boilers	969 50	
Mar. 13, 1877	Coast-Wrecking Company, services	75 00	
Apr. 7, 1877	M. A. Campbell, gauging	108 60	
Aug. 10, 1876	C. H. Delamater & Co., third payment on Colorado boilers	12,500 00	
Aug. 10, 1876	C. H. Delamater & Co., fourth payment on Colorado boilers	12,500 00	
Jan. 13, 1877	C. H. Delamater & Co., seventh payment on Colorado boilers.	4,500 00	
Feb. 9, 1877	C. H. Delamater & Co., eighth payment on Colorado boilers	25,000 00	
Mar. 17, 1877	Downie, Trainer & Co., packing	69 88	
Feb. 26, 1877	F. W. Devoe & Co., alcohol	122 50	
Apr. 7, 1877	Richard Dudgeon, jacks	693 86	
Feb. 28, 1877	William P. Eddy, freight	4 42	
Mar. 10, 1877	Eastern Railroad Company, freight	11 90	
Feb. 24, 1877	George P. Goff, stores	8,663 50	
Mar. 17, 1877	......do	4,621 72	
Mar. 17, 1877	......do	2,026 52	
Mar. 20, 1877	......do	4,896 15	
Apr. 14, 1877	......do	3,369 25	
July 2, 1876	The Harlan & Hollingsworth Company, repairs on Powhatan.	766 18	

A.—*Statement of indebtedness, &c.*—Continued.

Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.
	STEAM MACHINERY—Continued.		
	To pay approved bills.		
Feb. 21, 1877	The Harlan & Hollingsworth Company, removing Amphitrite machinery.	$291 13	
Mar. 17, 1877	George E. Hanson, stores	83 00	
Mar. 17, 1877	H. H. Ham, stores	3 50	
Mar. 22, 1877	J. D. Hurlburt & Son, freight	638 40	
Mar. 2, 1877	......do	296 73	
Apr. 19, 1877	......do	45 48	
June 23, 1877	......do	1,040 96	
July 3, 1877	......do	1,631 95	
Aug. 11, 1877	......do	377 67	
Mar. 1, 1877	Charles F. Hatch, agent, liquid-cooler	54 50	
Mar. 17, 1877	A. M. Ingersoll, paints	11,385 00	
Mar. 17, 1877	......do	1,771 50	
Apr. 1, 1877	George W. Knox, freight	7 65	
June 5, 1877	......do	9 56	
May 22, 1877	......do	2 95	
Mar. 20, 1877	Manhattan Oil Company, sperm-oil	9,653 86	
Apr. 1, 1877	Manhattan Oil Company, olive-oil	7,229 70	
Nov. 1, 1876	Murphy & Co., extra work on Huron	301 66	
Feb. 28, 1877	John Mullett, alcohol	13 75	
Apr. 4, 1877	John Mullett, camphor	12 00	
Mar. 17, 1877	A. A. McCullogh, fire-brick	271 44	
Mar. 17, 1877	Manhattan Packing Company, packing	719 75	
Feb. 16, 1877	Neafie & Levy, on account for erecting Quinnebaug machinery.	25,000 00	
Mar. 29, 1877	Old Dominion Steamship Company, freight	25 10	
July 7, 1877	......do	2 32	
July 11, 1876	Providence Steam-Engine Company, fourth payment for Lancaster boilers.	15,000 00	
Sept. 20, 1876	Providence Steam-Engine Company, fifth payment for Lancaster boilers.	15,000 00	
Dec. 27, 1876	Providence Steam-Engine Company, final payment for Lancaster boilers.	4,500 00	
Aug. 16, 1877	Providence Steam-Engine Company, final payment for Saco boilers.	43,911 30	
Aug. 2, 1877	Providence Steam-Engine Company, final payment for Yantic boilers.	38,904 02	
Aug. 28, 1877	Providence Steam-Engine Company, third payment for Kearsarge boilers.	25,000 00	
Sept. 6, 1877	Providence Steam-Engine Company, fourth payment for Kearsarge boilers.	20,000 00	
Sept. 6, 1877	Providence Steam-Engine Company, second payment for Omaha boilers.	30,000 00	
Sept. 6, 1877	Providence Steam-Engine Company, second payment for Richmond boilers.	20,000 00	
Apr. 26, 1877	Philadelphia and New York Steam-Navigation Company, freight.	2 12	
Oct. 5, 1875	Quintard Iron-Works, first payment for Alaska and Benicia boilers.	22,000 00	
Nov. 5, 1875	Quintard Iron-Works, second payment for Alaska and Benicia boilers.	20,000 00	
Dec. 1, 1875	Quintard Iron-Works, third payment for Alaska and Benicia boilers.	20,000 00	
Dec. 29, 1875	Quintard Iron-Works, fourth payment for Alaska and Benicia boilers.	20,000 00	
Feb. 5, 1876	Quintard Iron-Works, fifth payment for Alaska and Benicia boilers.	20,000 00	
Feb. 28, 1876	Quintard Iron-Works, sixth payment for Alaska and Benicia boilers.	20,000 00	
Mar. 27, 1876	Quintard Iron-Works, seventh payment for Alaska and Benicia boilers.	20,000 00	
Nov. 24, 1876	Quintard Iron-Works, eighth payment for Alaska and Benicia boilers.	3,082 54	
Nov. 24, 1876	Quintard Iron-Works, ninth payment for Alaska and Benicia boilers.	5,000 00	
Feb. 27, 1877	Rider & Cotton, brushes	106 58	
Jan. 3, 1876	T. F. Rowland, sixth and seventh payments for Monadnock boilers.	22,000 00	
Dec. 6, 1876	T. F. Rowland, eighth payment for Monadnock boilers	11,000 00	
Oct. 17, 1876	John Roach, second payment for Puritan boilers	20,370 00	

A—*Statement of indebtedness, &c*—Continued.

Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.
	STEAM MACHINERY—Continued.		
	To pay approved bills.		
Oct. 17, 1876	John Roach, third payment for Puritan boilers	$20,370 00	
Oct. 17, 1876	John Roach, fourth payment for Puritan boilers	20,370 00	
Feb. 1, 1877	John Roach, first and second payments for Brooklyn boilers.	15,000 00	
Aug. 2, 1877	John Roach, seventh, eighth, and ninth payments for Brooklyn boilers.	22,500 00	
Aug. 2, 1877	John Roach, final payment for Brooklyn boilers	10,228 20	
Feb. 1, 1877	John Roach, first and second payments for Franklin boilers.	24,000 00	
July 25, 1877	John Roach, seventh and eighth payments for Franklin boilers.	24,000 00	
Sept. 7, 1877	John Roach, alterations of Franklin boilers	10,152 36	
July 25, 1877	John Roach, third and fourth payments for Wabash boilers.	20,000 00	
July 25, 1877	John Roach, fifth payment for Wabash boilers	10,000 00	
Aug. 2, 1877	John Roach, sixth and seventh payments for Wabash boilers.	20,000 00	
Sept. 7, 1877	John Roach, eighth payment for Wabash boilers	10,000 00	
Mar. 16, 1877	John Roach, balance of reservation on Trenton's engines.	31,750 00	
Aug. 14, 1877	John Roach, cross-head for Trenton	769 25	
Mar. 17, 1877	Francis Raymond, freight	4 70	
July 16, 1877	South Boston Iron Company, first payment for Hartford boilers.	25,000 00	
July 16, 1877	South Boston Iron Company, second payment for Hartford boilers.	25,000 00	
Jan. 9, 1877	South Boston Iron Company, second payment for Shenandoah, Wachusett, and Triana boilers.	42,000 00	
Mar. 19, 1877	South Boston Iron Company, third payment for Shenandoah, Wachusett, and Triana boilers.	7,162 10	
Mar. 19, 1877	South Boston Iron Company, fourth payment for Shenandoah, Wachusett, and Triana boilers.	25,000 00	
Mar. 19, 1877	South Boston Iron Company, final payment for Shenandoah, Wachusett, and Triana boilers.	27,717 54	
May 5, 1877	Sutton & Co., freight	703 82	
July 3, 1877	......do	325 77	
May 28, 1877	Thomas M. Shephard, bearings	130 00	
Feb. 28, 1877	Twitchell, Pike & Co., locks	18 00	
Feb. 20, 1877	William A. Torrey & Co., rubber packing hose	9,608 70	
Feb. 20, 1877	......do	9,493 10	
Feb. 27, 1877	......do	3,721 40	
Feb. 27, 1877	......do	12,698 20	
Feb. 23, 1877	William A. Torrey & Co., rubber valves	385 62	
Mar. 1, 1877	William A. Torrey & Co., rubber packing	569 70	
Mar. 17, 1877	William A. Torrey & Co., rubber gaskets	45 00	
Feb. 23, 1877	Walton Brothers, heaters for Trenton	2,118 66	
Mar. 17, 1877	Walton Brothers, heaters for Enterprise	1,672 35	
Mar. 22, 1877	Walton Brothers, lamps for Trenton	259 20	
Apr. 4, 1877	Walton Brothers, heaters for Wyoming	1,716 99	
Apr. 13, 1877	Walton Brothers, oil-tanks	70 00	
May 17, 1877	Walton Brothers, heaters for Despatch	1,414 18	
May 31, 1877	Walton Brothers, heaters for Tallapoosa	1,443 25	
Feb. 15, 1877	E. V. White & Co., stores	108 68	
June 19, 1877	E. V. White & Co., packing	31 90	
July 9, 1877	E. M. Whittaker & Co., stationery	414 59	
Feb. 21, 1877	C. C. Walcott, governor for Trenton	876 71	
	Total to pay approved bills		$1,056,458 04

B.

Date of order or bill.	Detailed objects of expenditure and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.
	STEAM MACHINERY.		
	Claims for which bills have not yet been approved.		
Apr. 2, 1877	American Tube Works, brass tubes	$7,013 00	
Feb. 10, 1877	A. P. Brown, stores	3,000 00	
May 22, 1877	David Babcock & Co., stores	340 62	
June 22, 1877	David Babcock & Co., paint	49 90	
May 22, 1877	George H. Creed, screws	21 75	
May 23, 1877	Charles W. Cottle, wood	54 87	
May 18, 1877	Mercer Goodrich, stationery	1 58	
Feb. 23, 1877	J. M. Motley, Laubach's drills	4,320 00	
Aug. 26, 1876	Neafie & Levy, extras on erecting Quinnebaug's machinery.	15,218 64	
June 14, 1877	Old Dominion Steamship Company, freight	2 50	
Apr. 26, 1877	Pacific Mail Steamship Company, freight	773 95	
Feb. 13, 1877	Pratt & Whitney Company, stocks, taps, and dies, &c	22,739 93	
May 21, 1877	M. A. & C. A. Santos, varnish, &c	22 25	
June 12, 1877	M. A. & C. A. Santos, soda	7 50	
May 18, 1877	Sutton & Co., freight	3,716 97	
May 24, 1877	E. V. White & Co., padlocks	12 00	
May 14, 1877	Vickery & Co., stationery	109 30	
	Total claims, unapproved bills		$57,364 76

C.

Date of contract.	Detailed objects of expenditure and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.
	STEAM MACHINERY.		
	To pay balances under existing contracts.		
Apr. 14, 1875	William Cramp & Son, boilers for Terror, balance	66,698 27	
Dec. 14, 1875	C. H. Delamater & Co., boilers for Colorado, balance	17,713 07	
May 12, 1875	The Harlan & Hollingsworth Company, boilers for Amphitrite, balance.	78,179 08	
Apr. 5, 1875	Neafie & Levy, erecting Quinnebaug's engines, balance	5,000 00	
Nov. 27, 1876	Providence Steam-Engine Company, boilers for Kearsarge, balance.	20,000 00	
Feb. 18, 1877	Providence Steam-Engine Company, boilers for Omaha, balance.	67,266 20	
Feb. 18, 1877	Providence Steam-Engine-Company, boilers for Richmond, balance.	73,664 03	
Aug. 2, 1875	John Roach, engines for Miantonomoh, balance	34,000 00	
Sept. 5, 1876	John Roach, boilers for Puritan, balance	61,110 00	
Feb. 8, 1877	John Roach, boilers for Wabash, balance	43,259 01	
Nov. 21, 1876	John Roach, boilers for Franklin, balance	4,203 00	
Apr. 13, 1875	T. F. Rowland, boilers for Monadnock, balance	44,000 00	
Dec. 4, 1876	South Boston Iron Company, boilers for Hartford, balance	30,000 00	
	Total to pay balances on contracts		$545,092 66

D.

Date of contract.	Detailed objects of expenditure and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.
	Suspended contracts.		
Mar. 3, 1877	Phineas Burgess, engines for Monadnock*	$285,000 00	
Mar. 3, 1877	William Cramp & Sons, engines for Terror*	230,000 00	
Mar. 3, 1877	Harlan & Hollingsworth Company, engines for Amphitrite*	230,000 00	
Mar. 3, 1877	John Roach, engines for Puritan*	420,000 00	
Mar. 7, 1877	South Boston Iron Company, boilers for Tuscarora	75,000 00	
Mar. 7, 1877	South Boston Iron Company, boilers for Narragansett	70,000 00	
Mar. 7, 1877	South Boston Iron Company, boilers for Snowdrop	20,000 00	
Mar. 10, 1877	South Boston Iron Company, boilers for Dictator	175,000 00	
	Total suspended contracts		$1,505,000 00

* Suspended contracts on work in progress under previous orders and contracts.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, by the Bureau of Steam Engineering, Navy Department.

Detailed objects of expenditure and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
SALARIES.			
Chief clerk, per act August 15, 1876 (19 Stat. at L., p. 162, ch. 287)		$1,800 00	....
Draughtsman, per act August 15, 1876 (19 Stat. at L., p. 162, ch. 287)		1,800 00	....
Assistant draughtsman, per act August 15, 1876 (19 Stat. at L., p. 162, ch. 287)		1,600 00	....
One clerk of class two, per act August 15, 1876 (19 Stat. at L., p. 162, ch. 287)		1,400 00	....
One messenger, per act August 15, 1876 (19 Stat. at L., p. 162, ch. 287)		840 00	....
One laborer, per act August 15, 1876 (19 Stat. at L., p. 162, ch. 287)		720 00	....
		8,160 00	$8,160 00
Two clerks of class three (submitted)		3,200 00	....
One clerk of class one (submitted)		1,200 00	....
One laborer (submitted)		720 00	....
		5,120 00	....
		13,280 00	....
CONTINGENT.			
For stationery and miscellaneous items, per act August 15, 1876 (19 Stat. at L., p. 162, ch. 287)		1,500 00	700 00
STEAM MACHINERY.			
For preservation of machinery, boilers, &c., in vessels on the stocks and in ordinary; purchase and preservation of all materials and stores; purchase, fitting, and repair of machinery and tools in the navy-yards; labor in the navy-yards and stations; wear, tear, and repair of machinery, boilers, &c., of naval vessels; incidental expenses, namely, foreign postage, telegrams, advertising, freight, &c., per act March 3, 1877 (19 Stat. at L., p. 389, sec. 111)		1,000,000 00	942,000 00
CIVIL ESTABLISHMENT.			
Portsmouth, N. H., navy-yard:			
One clerk	$1,300 00		
One writer (store)	1,017 25		
One draughtsman	1,600 00		
		3,917 25	....
Boston, Mass., navy-yard:			
One clerk	1,400 00		
One clerk (store)	1,400 00		
One draughtsman	1,600 00		
		4,400 00	....

Estimates of appropriations required for the service, &c.—Continued.

Detailed objects of expenditure, and explanations.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
Brooklyn, N. Y., navy-yard:			
One clerk	$1,400 00		
One clerk	1,300 00		
One writer (store)	1,017 25		
One draughtsman	1,600 00		
		$5,317 25	
League Island, Pa., navy-yard:			
One clerk	1,300 00		
One writer (store)	1,017 25		
One draughtsman	1,600 00		
		3,917 25	
Washington, D. C., navy-yard:			
One clerk	1,300 00		
One writer, (store)	1,017 25		
One draughtsman	1,600 00		
One writer	1,017 25		
		4,934 50	
Norfolk, Va., navy-yard:			
One clerk	1,300 00		
One writer (store)	1,017 25		
One draughtsman	1,600 00		
		3,917 25	
Pensacola, Fla., navy-yard:			
One writer		1,017 25	
Mare Island, Cal., navy-yard:			
One clerk	1,400 00		
One clerk	1,300 00		
One draughtsman	1,600 00		
		4,300 00	
		31,720 75	

No. 10.—BUREAU OF CONSTRUCTION AND REPAIR.

NAVY DEPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR,
October 26, 1877.

SIR: In compliance with your instructions, I have the honor to inclose herewith the estimates for the expenditures of this bureau for the fiscal year terminating 30th June, 1879, and also a list of offers to furnish materials for the Navy, under the advertisement of this bureau dated August 21, 1877.

I remain, sir, very respectfully, your obedient servant,

J. W. EASBY,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

NAVY DEPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR,
October 26, 1877.

SIR: I have the honor to submit, in conformity with your instructions, statements of the work of the bureau for the past year and estimates covering expenditures required for the fiscal year ending June 30, 1879.

1876.			1876-'77.
July 1.	—Amount appropriated		$1,750,000 00
Nov.	—Amount appropriated		200,000 00
Dec.	—Received from other bureaus		61,036 33
1877.			
Feb.	—Received from sale of Philadelphia yard		50,000 00
March.	—Received from sale of Philadelphia yard		10,000 00
April.	—Received from Paymaster Gilman		11,009 80
May.	—Received from double-turreted monitors		3,817 15
			2,085,863 28
Expended from July 1, 1876, to June 30, 1877:			
	For materials, &c	$1,543,590 87	
	For navy yards	541,335 86	
			2,084,926 73
Balance on hand July 1, 1877			936 55

Vessels repaired or completed, 1877-'78.

Adams.
Alarm.
Alert.
Alliance.
Antietam.
Benicia.
Camanche.
Canandaigua.
Catskill.
Cohasset.
Colorado.
Congress.
Connecticut.
Constellation.
Constitution.
Despatch.
Emerald.
Enterprise.
Essex.
Fortune.
Franklin.
Gettysburg.
Glance.
Hartford.
Huron.
Independence.
Intrepid.
Iowa.
Iroquois.
Jason.
Jean Sands.
Juniata.
Kansas.
Lackawanna.
Lancaster.
Lehigh.
Leyden.
Minnesota.
Mohican.
Monongahela.
Mayflower.
Montauk.
Monterey.
Nahant.
Nantucket.
Naragansett.
New Hampshire.
Niagara.
Nina.
Nyack.
Ohio.
Oregon.
Pawnee.
Passaic.

Pensacola.
Pilgrim.
Pinta.
Portsmouth.
Potomac.
Powhatan.
Plymouth.
Quinnebaug.
Ranger.
Relief.
Rescue.
Rose.
Sabine.
Saco.
Saratoga.
Saugus.
Seaweed.
Shawmut.
Snowdrop.
Speedwell.
Saint Louis.
Supply.
Swatara.
Tallapoosa.
Ticonderoga.
Trenton.
Triana.
Tuscarora.
Vandalia.
Wabash.
Wachusett.
Worcester.
Wyandotte.
Wyoming.
Yantic.

Of the five first-rates, three are in service as receiving ships, one as a training-ship, and the other is laid up in ordinary. Considering the extensive repairs which would be required, and the expense of keeping these ships in commission at sea, the present disposition of them is regarded as the best that can be made.

Of the second-rates, the Connecticut, Java, and Pennsylvania, now on the stocks in an unfinished condition, and having white-oak frames, have so far deteriorated as to make it unadvisable to complete them. They should be appraised and offered for sale at auction. The Florida and Lancaster, now in ordinary, and the New York, on the stocks, will require a large sum of money to repair or complete and equip for sea, but as they are much needed for flag-ships, they should be taken in hand as soon as the appropriation will admit of it. The Iowa, Susquehanna, Congress, and Worcester, now in ordinary, are not worth repairing, and should be sold at public auction. The remainder of the vessels of this class can be kept in commission, or repaired, as their services may be required.

Of the third-rates, the Kansas, Nyack, Saco, and Shawmut are unfit for repairs. The Galena, Mohican, and Nipsic are on the stocks, and will be completed as rapidly as the funds of the bureau will admit of. The Swatara, Vandalia, Marion, Adams, Alliance, Essex, Alert, Huron, Ranger, and Enterprise are now in commission. The Quinnebaug is afloat, and will be put in commission in a few months. The remaining vessels of this rate are in commission or awaiting repairs.

The six fourth-rate steamers are in commission and usefully employed.

Of the wooden sailing-vessels, the Ohio, Sabine, and Cyane are unfit for use; and the New Orleans, on the stocks at Sacket's Harbor, is not worth finishing. These should all be sold or broken up. The remaining vessels of this rate are used as store, training, receiving, or school-ships. To the list of vessels to be sold should be added the ferry-boat Burlington, and to those to be broken up, the old ship of the line Virginia.

Of our armored vessels, the Colossus, Massachusetts, and Oregon, now on the stocks, and having frames of white oak, and the Roanoke afloat, have so far deteriorated that they should be broken up, and the metal material utilized in other constructions. The Dictator requires extensive repairs, and, as she is one of our best monitors when in order, these repairs should be commenced as soon as the appropriations will allow it. The Terror, Puritan, Miantonomoh, Amphitrite, and Monadnock, all double-turreted twin-screw monitors, are in course of construction by contract; work, however, being suspended at present on all but the Miantonomoh and Monadnock. These five vessels, being the most powerful we have, should be finished without delay, and it is earnestly asked that Congress may make the required appropriation to complete them.

The remaining iron-clad vessels, fourteen in number, are in good condition, and ready for service when required.

The torpedo-boats Intrepid and Alarm are in commission and ready for any emergency requiring their use.

As some of the vessels for which we have most use are now in want of extensive repairs, and are required for immediate service, an additional appropriation for the present fiscal year of $500,000 is asked for, and would enable us to put these vessels in order without the delay which must necessarily ensue if we have to wait for the appropriation for the year 1878–'79.

The vessels we shall stand most in need of in the near future are those suitable for flag-ships; and while we have several good vessels worth rebuilding or finishing for this purpose (such as the Florida, Lancaster, and New York), yet it would be wise policy to authorize the construction of four large ships to take the places of those now in commission; the time for building these vessels might extend over a period of four years, and, therefore, only one-fourth of the amount of their cost would be required at present.

In addition to these large vessels, I would ask for authority to build four very light draught swift gunboats, for use on our own coast; their cost would not exceed, in construction department, over $120,000 each, and is included in the estimates for 1878–'79.

While European nations are expending large sums of money in the construction of armored vessels of great variety of type, it is not deemed advisable at this time to increase our Navy in this direction.

We find that in many instances ships have been laid aside as useless because of their peculiar construction, and others are being built which may share the same fate. We can profit by the experience of other nations while the transition from unarmored and sailing to armored and mastless ships is going on.

I would respectfully call your attention to the corps of naval constructors. Experience has proved the importance of limiting the number of these officers, and I would suggest that their number be limited by law to nine, and the number of assistant naval constructors to eight; all constructors now having commissions to retain them, and no others to be appointed until the number is below that specified.

The efficiency of assistant naval constructors would be greatly promoted by making them commissioned officers and they would be relieved from the uncertainty of the tenure by which they now hold office.

I desire also to call your attention to the present uncertain method of fitting young men for the position of assistant naval constructors, or rather the want of a method, and would suggest the creation of a corps of cadet naval constructors, admission to the corps to depend upon a competitive examination of candidates not over twenty-one years of age, a prerequisite to such examination being such knowledge of the practice of ship-building as may be obtained by actually working at the business for at least three years, not more than two candidates to be selected from the number presenting themselves biennially. The cadet constructors to pass three years at the Naval Academy in obtaining a knowledge of the theory of naval architecture, and to have facilities for studying such other branches as may be required to fit them for usefulness in their profession. After this course of study they should be sent to a navy-yard to assist the naval constructor in all work in his department, and in the absence of both naval constructor and assistant naval constructor to have charge of construction department. At the expiration of two years to be sent to sea on a cruising-ship for one year, at the end of which time to be examined for the position of assistant naval constructor; if the examination is satisfactory, to be appointed to the first vacancy in the corps, and, while waiting for a vacancy, to be employed in assisting the naval constructor in a navy-yard, still retaining his title of cadet constructor.

I would call your attention to the reports received at various times of depredations on our live-oak lands, and to prevent the loss of this valuable timber I would suggest that agents be appointed, as in former years, to see that these reservations are properly cared for. The expense attending this service is included in the estimates for the year.

All of which is respectfully submitted.

J. W. EASBY,
Chief of Bureau.

Hon. R. W. THOMPSON,
Secretary of the Navy.

NO. —. STATEMENTS OF INDEBTEDNESS.

Indebtedness of Bureau of Construction and Repair.

General object.	Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1877.
Construction and Repair, 1876–'77.					
Anthony & Co.	1877, Jan. 24	Sundries	....	$122 30	
Bashor & Co	1876, Nov. 24	Timber	$4,321 76		
Do	1876, Dec. 7	......do	4,049 01		
Do	1876, Dec. 22	......do	3,757 67		
Do	1876, Dec. 23	......do	4,934 21		
Do	1877, Mar. 7	......do	2,682 57		
Do	1876, Nov. 13	......do	3,768 36		
Do	1876, Oct. 3	......do	6,012 93		
				29,526 51	
Bridgewater Iron Co.	1877, Apr. 12	Iron	....	52 00	
Brown, S. P	1877, Mar. 13	Timber	1,098 24		
Do	1877, Feb. 27	......do	2,016 05		
				3,114 29	
Burgess, Phineas	1876, Oct. 21	Third payment on account of United States ship Monadnock.	19,521 00		
Do	1876, Oct. 21	Fourth payment on account of United States ship Monadnock.	19,521 00		
Do	1876, Dec. 9	Fifth payment on account of United States ship Monadnock.	19,521 00		
Do	1877, Jan. 24	Sixth payment on account of United States ship Monadnock.	19,521 00		
Do	1877, Feb. 9	Seventh payment on account of United States ship Monadnock.	19,521 00		
Do	1877, Mar. 3	Eighth payment on account of United States ship Monadnock.	19,521 00		
Do	1877, Mar. 3	Ninth payment on account of United States ship Monadnock.	19,521 00		
Do	1877, Feb. 9	For extra work on account of United States ship Monadnock.	2,000 00		
Do	1877, Jan. 25	For freight on account of United States ship Monadnock.	508 45		
Do	1875, Dec. 20	For twentieth payment on account of United States ship Camanche.	12,500 00	151,655 45	

Indebtedness of Bureau of Construction and Repair—Continued.

General object.	Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1877.
Construction and Repair, 1876–'77.					
Bigler, J. & Co	1877, Mar. 6	Timber	$13,901 10		
Do	1877, Mar. 6	do	4,856 98		
Do	1877, Mar. 6	do	6,425 30		
				$25,183 38	
Do	1877, Mar. 6			9,617 52	$42,191 96
Do	1877, Mar. 6			7,391 06	
Buker, J. W	1877, Feb. 6	Sundries		196 38	
Cramp & Sons	1876, Jan. 29	First and second payments on account of United States ship Terror.	24,800 00		
Do	1876, Oct. 19	Freight on scrap-iron	2,144 55		
				26,944 55	
Chase, C. M	1876, Dec. 5	Sundries		45 10	
Creed, George H	1877, Apr. 2	do	575 25		
Do	1877, Mar. 19	do	228 80		
Do	1877, Feb. 16	do	363 95		
Do	1877, Feb. 13	do	31 80		
Do	1877, Mar. 2	do	31 20		
Do	1877, Mar. 1	do	389 00		
Do	1877, Mar. 1	do	1,379 75		
Do	1877, Mar. 7	do	153 65		
Do	1877, Mar. 7	do	27 50		
Do	1877, Mar. 7	do	1,130 10		
Do	1877, Jan. 27	do	14 53		
Do	1877, Jan. 27	do	87 50		
Do	1877, Jan. 27	do	180 00		
Do	1877, Jan. 27	do	146 20		
Do	1877, Jan. 27	do	5 00		
Do	1877, Feb. 2	do	230 15		
Do	1877, Feb. 2	do	76 78		
Do	1877, Jan. 13	do	325 68		
Do	1877, Jan. 12	do	95 53		
Do	1877, Jan. 12	do	65 00		
Do	1877, Jan. 13	do	6 00		
Do	1877, Jan. 13	do	290 52		
Do	1876, Dec. 27	do	13 50		
Do	1876, Dec. 27	do	449 80		
Do	1876, Dec. 27	do	87 84		
Do	1876, Nov. 18	do	59 37		
Do	1876, Dec. 13	do	72 00		
Do	1876, Dec. 14	do	201 60		
Do	1876, Dec. 13	do	156 30		
Do	1876, Dec. 13	do	141 90		
Do	1876, Nov. 9	do	1,665 50		
Do	1876, Nov. 8	do	23 15		
Do	1876, Nov. 8	do	96 00		
Do	1876, Nov. 8	do	220 00		
Do	1876, Oct. 7	do	96 20		
Do	1876, Oct. 7	do	1,380 00		
Do	1876, Oct. 7	do	4,710 73		
Do	1876, Oct. 7	do	2,787 90		
Goff, George P	1877, Mar. 27	do		585 52	
Griffiths, J. W	1876, Mar. 27	For labor in building United States ship Enterprise.	1,612 00		
Do	1877, Feb. 28	For extras in building United States ship Enterprise.	3,519 15		
				5,131 15	
Harlan & Hollingsworth Company.	1877, Feb. 28	First, second, and third payments on account United States ship Amphitrite.	46,500 00		
Do	1877, Feb. 28	Fourth, fifth, sixth, and seventh payments on account United States ship Amphitrite.	62,000 00		
Do	1877, Feb. 28	Eighth, ninth, and tenth payments on account United States ship Amphitrite.	37,200 00		
Do		Reservation due on account United States ship Amphitrite (bill not made out yet).	9,300 00		

Indebtedness of Bureau of Construction and Repair—Continued.

General object.	Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1877.
Construction and Repair, 1876–'77.					
Harlan & Hollingsworth Company.	1877, Feb. 28	New materials on account United States ship Amphitrite.	$24, 889 87		
Do	1877, Feb. 28	Balance due on account United States ship Ranger.	50, 000 00		
Do	1876, Dec. 20	Extra work on account United States ship Ranger.	2, 842 94		
Do	1877, Jan. 19	Timber-head for account United States ship Jason.	31 00		
				$232, 763 81	
Hatch & Co	1876, Sept. 12	Timber	7, 015 66		
Do	1876, Sept. 22	do	2, 323 71		
Do	1876, Sept. 11	do	7, 184 97		
Do	1876, Dec. 22	do	1, 905 88		
Do	1876, Dec. 22	do	2, 604 00		
Hatch, Loud & Co	1876, Sept. 22	do	2, 623 53		
Do	1876, Sept. 11	do	4, 728 95		
Do	1876, Oct. 10	do	7, 415 48		
Do	1876, Dec. 22	do	3, 100 00		
Do	1876, Dec. 26	do	11, 100 00		
Do	1876, Dec. 26	do	5, 400 00		
Do	1877, Jan. 31	do	7, 020 00		
Do	1877, Jan. 31	do	8, 010 00		
Do	1877, Jan. 31	do	3, 465 00		
Do	1877, Jan. 31	do	4, 005 00		
Do	1877, Mar. 3	do	4, 165 24		
Do	1877, Mar. 3	do	2, 550 00		
Do	1877, Mar. 3	do	6, 576 97		
				91, 194 39	
Jewett, E. H	1877, Jan. 6	do		5, 084 40	
Knowltor, J. L	1876, Oct. 5	Tools	2, 150 00		
Do	1876, Sept. 21	do	2, 150 00		
				4, 300 00	
Lindsay, A. H	1877, Jan. 20	Timber		7, 830 51	
Manton, Jos. L	1877, Feb. 1	Steam windlass		5, 900 00	
McKay, Donald	1877, Feb. 20	Balance due on account of United States ship Adams.	796 18		
Do	1877, Feb. 20	Extra work due on account United States ship Adams.	5, 865 66		
Do	1877, Feb. 20	Extra work due on account United States ship Essex.	2, 196 83		
				8, 858 67	
McKay, Nathaniel	1877, Feb. 9	Extra work due on account United States ship Phlox.		4, 400 00	
McCullough, A. A	1876, Aug. 26	Timber	994 03		
Do	1876, Dec. 16	do	3, 281 00		
Do	1876, Dec. 23	do	2, 427 84		
				6, 702 87	
New Jersey Navigation Company.	1876, Mar. 16	Charter of United States ship Burlington.	3, 000 00		
Do	1876, Apr. 18	do	1, 000 00		
				4, 000 00	
Place, George	1877, Feb. 13	Machinery		23, 710 00	
Phelps Manufacturing Company.	1877, Feb. 1	Sundries		334 60	
Rowland, T. F	1876, Dec. 6	Insurance of United States ship Catskill.	8, 000 00		
Do	1877, Mar. 15	Turret lifts of United States ship Monadnock.	3, 000 00		
				11, 000 00	
Raymond, C. H	1876, Dec. 29	Coal		3, 451 50	
Rider & Cotton	1877, Mar. 12	Sundries		184 77	
Roach John	1876, Aug. 16	Tenth payment on account of United States ship Puritan, in frame.	12, 400 00		
Do	1877, Apr. 13	Tenth payment on account of United States ship Puritan, continuing work.	16, 560 00		
Do	1876, Aug. 16	Reservation on account of United States ship Puritan.	31,000 00		

Indebtedness of Bureau of Construction and Repair—Continued.

General object.	Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1877.
Construction and Repair, 1876–'77.					
Roach, John	1877, Mar. 3	Reservation on account of United States ship Puritan.	$4,464 77		
Do	1877, Apr. 13	Cutting up the old Puritan.	6,000 00		
Do	1876, Nov. 10	First payment on account of United States ship Miantonomoh.	31,365 00		
Do	1876, Nov. 10	Second payment on account of United States ship Miantonomoh.	31,365 00		
Do	1876, Nov. 10	Third payment on account of United States ship Miantonomoh.	31,365 00		
Do	1876, Dec. 7	Fourth payment on account of United States ship Miantonomoh.	31,365 00		
Do	1877, Feb. 9	Fifth payment on account of United States ship Miantonomoh.	31,365 00		
Do	1877, Feb. 9	Sixth payment on account of United States ship Miantonomoh.	31,365 00	$258,614 77	
Savage, Jos. L	1876, Dec. 16	White-oak knees		268 00	
Santos, M. A. & C. A	1877, Jan. 17	Sundries	65 00		
Do	1877, Feb. 2	do	90 00		
				155 00	
Steele, W. F	1876, Oct. 5	Balance due for plumbing, United States ship Quinnebaug.		3,400 00	
Stevens, S. A., & Co	1876, Dec. 26	Sundries		131 69	
Smith, F. A	1877, Mar. 1	Live-oak timber	13,411 83		
Do	1877, Mar. 1	do	2,037 80		
Do	1877, Mar. 1	do	38,381 12		
				53,830 75	
Trickey, John	1877, Mar. 29	Timber	249 00		
Do	1877, Feb. 27	do	967 67		
Do	1877, Feb. 27	do	520 70		
Do	1876, Nov. 25	do	1,874 70		
Do	1876, Nov. 16	do	349 85		
Do	1876, Nov. 24	do	2,752 92		
Do	1876, Dec. 7	do	766 18		
				7,481 02	
Tatham Bros	1876, Oct. 5	Sundries		128 43	
Taylor, Elliot & Co	1877, Jan. 27	do		89 97	
Torrey, W. A	1877, Mar. 9	do		76 00	
Vanderbilt, H. S	1876, Nov. 27	Timber	2,752 32		
Do	1877, Feb. 21	do	6,489 36		
Do	1877, Feb. 21	do	2,489 15		
Do	1877, Feb. 21	do	2,478 68		
				14,209 51	
White, E. V., & Co	1876, Aug. 18	Sundries	82 20		
Do	1876, Dec. 19	do	90 00		
Do	1876, Dec. 12	do	88 00		
Do	1877, Jan. 26	do	4 20		
Do	1877, Jan. 26	do	47 18		
Do	1877, Jan. 30	do	40 20		
				351 78	
White, W	1877, Mar. 27	Timber		18,389 10	
Wood & Dialogue	1876, Sept. 25	Repairs done to the United States ship Mayflower.	4,781 56		
Do	1876, Sept. 25	do	5,532 95		
Do	1876, Oct. 14	Repairs done to the United States ship Constitution.	5,000 00		
Do	1877, Jan. 6	do	5,000 00		
				20,314 51	
Walton Bros	1877, Mar. 2	Sundries		18 00	
Due on account of pay-rolls.		At the navy-yard, Portsmouth, for the month of February, 1876.	2,002 28		
Do		At the navy-yard, Portsmouth, for the month of March, 1876.	1,972 42		

Indebtedness of Bureau of Construction and Repair—Continued.

General object.	Date of bill.	Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1877.
Construction and Repair, 1876–'77.					
Due on account of pay-rolls.	....	At the navy-yard, Portsmouth, for the month of April, 1876.	$1,605 74	$5,581 44	
Do..............	....	At the navy-yard, New York, for the month of February, 1876.	14,254 56		
Do..............	....	At the navy-yard, New York, for the month of March, 1876.	6,928 70	21,183 26	
Do..............	....	At the navy-yard, League Island, for the month of March, 1876.	....	1,185 06	
		Due for work on double-turreted monitors under agreements of—			
Burgess, Phineas....	1875, Oct. 2	On account of United States ship Monadnock.	....	41,211 00	
Cramp, W., & Sons..	1875, Apr. 5	On account of United States ship Terror.	....	55,800 00	
Roach, John.........	1876, Sept. 29	On account of United States ship Miantonomoh.	....	160,310 00	
				257,321 00	
		Claims known to exist under orders from the bureau.			
Providence Steam-Engine Company.	1876, Oct. 25	One steam windlass........	5,800 00		
Do..............	1876, Oct. 25	One steam steering-machine	7,300 00		
A. M. Ingersoll.......	1877, Jan. 25	Ten life-boats..............	15,000 00		
American Windlass Company.	1877, Feb. 24	One steam windlass........	6,200 00	34,300 00	
		Claims presented but unadjusted, on file in bureau.			
W. B. Reamy, agent..	1874, July —	Use of boat-davits on Lehigh.	200 00		
Do..............	1874, July —	Use of boat-davits on Canonicus.	200 00		
J. K. Frothingham...	1874, —— —	Metallic packing on Intrepid.	1,250 00		
Seyfert, McManus & Co.	——, —— —	Iron delivered at League Island.	29,674 92		
T. F. Rowland.......	1875, —— —	Loading frame of Monadnock.	1,386 48		
Do..............	1875, —— —	Riveting frame of Monadnock.	1,512 48		
John Roach.........	1876, Feb. —	Extras on account of Ranger	250 00		
Wood & Dialogue (J. H. Dialogue).	1877, Jan. —	Deck-house on Constitution.	1,000 00		
Do..............	1877, Jan. —	Extra labor on Constitution.	3,948 55	39,422 43	
Nathaniel McKay....	1875, —— —	Removing materials from Philadelphia to League Island, expenses incurred by delay.	....	2,500 00	
				41,922 43	$1,426,228 13

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, *by the Bureau of Construction and Repair.*

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
SALARIES.		
Chief clerk, per act of March 3, 1877 (19 Stats. at L., p. 312; R. S., p. 69, sec. 416)	$1,800 00	....
Draughtsman, per act of March 3, 1877 (19 Stats. at L., p. 312; R. S., p. 69, sec. 416)	1,800 00	....
One clerk of class four, per act of March 3, 1877 (19 Stats. at L., p. 312)......	1,800 00	....
One clerk of class three, per act of March 3, 1877 (19 Stats. at L., p. 312)......	1,600 00	....
One clerk of class two, per act of March 3, 1877 (19 Stats. at L., p. 312)......	1,400 00	....
One messenger, per act of March 3, 1877 (19 Stats. at L., p. 312)	840 00	....
One laborer, per act of March 3, 1877 (19 Stats. at L., p. 312)..................	720 00	....
	9,960 00	$9,960 00
One clerk of class three (submitted)	1,600 00	....
One clerk of class two (submitted)...	1,400 00	....
One assistant draughtsman (submitted)	1,600 00	....
Increase of pay of chief clerk (submitted)..	200 00	....
	4,800 00	....
CONTINGENT.		
Stationery and miscellaneous items (appropriated, vol. 19, p. 162)............	800 00	400 00
CONSTRUCTION AND REPAIR OF VESSELS.		
Preservation of vessels on the stocks and in ordinary; purchase of materials and stores of all kinds; labor in navy-yards and on foreign stations; preservation of material; purchase of tools; wear, tear, and repair of vessels afloat, and for general care and protection of the Navy in the line of construction and repair; incidental expenses, namely, advertising and foreign postage, (appropriated, 19 Stats. at L., p. 389)	2,250,000 00	1,750,000 00
CIVIL ESTABLISHMENT.		
At the navy-yard, Kittery, Me.:		
One clerk to naval constructor	1,400 00	....
One clerk of store-houses..	1,300 00	....
One draughtsman	1,600 00	....
Three writers, each at $1,000 per annum..	3,000 00	....
	7,300 00	....
At the navy-yard, Boston, Mass.:		
One clerk to naval constructor..	1,400 00	....
One clerk of store-houses...	1,300 00	....
One draughtsman..	1,600 00	....
Four writers, each at $1,000 per annum...	4,000 00	....
	8,300 00	....
At the navy-yard, Brooklyn, N. Y.:		
One clerk to naval constructor	1,400 00	....
One clerk of store-houses	1,300 00	....
One draughtsman	1,600 00	....
Four writers, each at $1,000 per annum	4,000 00	....
	8,300 00	....
At the navy-yard, League Island, Pa.:		
One clerk to naval constructor	1,400 00	....
One clerk of store-houses	1,300 00	....
One draughtsman	1,600 00	....
Three writers, each at $1,000 per annum	3,000 00	....
	7,300 00	....
At the navy-yard, Washington, D. C.:		
One clerk to naval constructor..	1,400 00	....
One clerk of store-houses...	1,300 00	....
One draughtsman..	1,600 00	....
Three writers, each at $1,000 per annum	3,000 00	....
	7,300 00	....

Estimates of appropriations required for the service of the fiscal year ending June 30 1879, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30 1878.
CIVIL ESTABLISHMENT—Continued.		
At the navy-yard, Norfolk, Va.:		
One clerk to naval constructor	$1,400 00	....
One clerk of store-houses	1,300 00	....
One draughtsman	1,600 00	....
Three writers, each at $1,000 per annum	3,000 00	....
	7,300 00	....
At the navy-yard, Pensacola, Fla.:		
One writer	1,000 00	....
At the navy-yard, Mare Island, Cal.:		
One clerk to naval constructor	1,400 00	....
One clerk of store-houses	1,300 00	....
One draughtsman	1,600 00	....
Three writers, each at $1,000 per annum	3,000 00	....
	7,300 00	....

Offers to furnish material for the Navy under the advertisement of the Bureau of Construction and Repair, of August 21, 1877, at the navy-yard, Portsmouth, N. H.

Class No. 4. White-oak plank:

Elisha H. Jewett	*$600 00
James & Abbott	640 00
A. A. McCullough	650 00
S. C. Carll	700 00
George T. Wallace	800 00

Class No. 13. White-pine plank, boards:

James & Abbott	*697 50
Elisha H. Jewett	700 00
A. A. McCullough	850 00
George A. Hammond	875 00
S. C. Carll	1,500 00

Class No. 15. White ash:

A. A. McCullough	*568 50
George C. Ludlam	585 00
Elisha H. Jewett	650 00
S. C. Carll	675 00
James & Abbott	699 00
George A. Hammond	897 00

Class No. 16. White-ash oars:

DeGrauw, Aymar & Co	*82 94
George D. Putnam & Co.	86 71
Fred'k A. Southmayd	96 13
J. H. Walker	103 67
David Babcock & Co	109 33
S. C. Carll	132 80

Class No. 18. Black Walnut, &c:

Elisha H. Jewett	*$540 00
A. A. McCullough	736 00
S. C. Carll	860 00
James & Abbott	891 00
George C. Ludlam	1,260 00

Class No. 25. Lignum-vitæ:

David Babcock & Co	*148 50
H. Lissberger	153 00
Elisha H. Jewett	195 00
J. H. Walker	198 00
S. C. Carll	210 00
George D. Putnam & Co.	225 00

Class No. 32. Wrought iron, round and square:

H. Lissberger	*35 00
J. H. Walker	47 50
Bellah, Quigley & Co	60 00
George D. Putnam & Co.	60 00
S. C. Carll	70 00

Class No. 33. Wrought iron, flat:

H. Lissberger	*67 00
J. H. Walker	97 00
Bellah, Quigley & Co	106 50
George D. Putnam & Co.	121 50
S. C. Carll	140 00

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*Accepted.

Class No. 35. Steel:

H. Lissberger	*$79 69
James D. Rowland	81 25
J. H. Walker	84 38
Midvale Steel Works	85 93
Bellah, Quigley & Co	96 87
George D. Putnam & Co.	100 00
S. C. Carll	118 00

Class No. 39. Iron cut nails:

H. Lissberger	*355 30
Bellah, Quigley & Co	398 10
J. H. Walker	402 00
Noblit, Brown, Noblit & Co.	410 65
S. C. Carll	471 25

Class No. 42. Lead, pipe, sheet:

H. Lissberger	*807 30
Robert Leitch & Sons	897 00
Bellah, Quigley & Co	979 80
J. H. Walker	946 25
George D. Putnam & Co.	995 00
David Babcock & Co	995 50
S. C. Carll	1,173 00
James D. Rowland	1,173 00

Class No. 44. Tin:

H. Lissberger	*1,447 50
S. C. Carll	1,591 50
David Babcock & Co	1,647 00
George D. Putnam & Co.	1,656 00
Bellah, Quigley & Co	1,716 00
J. H. Walker	1,729 32
James D. Rowland	1,860 00

Class No. 48. Locks, hinges, &c.:

H. Lissberger	*491 75
J. H. Walker	579 30
J. W. Gaskill & Sons	894 58
Dell Noblit, jr	1,270 14
S. C. Carll	1,329 80

Class No. 49. Screws:

George D. Putnam & Co.	*212 00
Dell Noblit, jr	214 72
H. Lissberger	218 08
J. H. Walker	238 34
J. W. Gaskill & Sons	245 92
Bellah, Quigley & Co	252 68
S. C. Carll	445 94

Class No. 50. Files:

J. H. Walker	228 67
Joseph J. Walton	252 01
C. H. Wight	272 84
H. Lissberger	281 45
Dell Noblit, jr	289 28
J. W. Gaskill & Sons	314 21
George D. Putnam & Co.	317 13
Bellah, Quigley & Co	317 65
S. C. Carll	669 50

Class No. 52. Tools for ship's stores:

H. Lissberger	*$259 30
J. H. Walker	303 08
S. C. Carll	752 48

Class No. 53. Tools for yard use:

H. Lissberger	*214 15
George D. Putnam & Co.	773 18
J. H. Walker	837 60
S. C. Carll	1,171 15

Class No. 54. Hardware:

H. Lissberger	*622 46
J. H. Walker	759 40
George D. Putnam & Co.	859 90
S. C. Carll	1,173 25

Class No. 56. White lead:

H. Lissberger	*501 00
Bellah, Quigley & Co	548 75
Thomas S. Harrison	551 10
C. T. Raynolds & Co	557 50
U. S. White Lead Co	565 00
George D. Putnam & Co.	573 00
Joseph J. Walton	580 00
J. H. Walker	585 00
J. H. Baker	592 50
S. C. Carll	685 00
David Babcock & Co	687 50

Class No. 57. Zinc paints.

C. T. Raynolds & Co	*110 00
H. Lissberger	120 00
U. S. White Lead Co	130 00
Joseph J. Walton	130 00
George D. Putnam & Co.	138 00
J. H. Walker	140 00
Bellah, Quigley & Co	140 00
David Babcock & Co	155 00
C. A. Burgess	170 00
S. C. Carll	170 00
J. H. Baker	190 00

Class No. 58. Colored paints:

Thomas S. Harrison	*41 90
J. H. Walker	45 35
C. T. Raynolds & Co	47 45
J. H. Baker	51 00
Joseph J. Walton	54 25
Bellah, Quigley & Co	60 00
George D. Putnam & Co.	61 80
U. S. White Lead Co	64 80
David Babcock & Co	73 50
H. Lissberger	81 85
C. A. Burgess	88 25
S. C. Carll	147 25

Class No. 60. Varnish, &c.:

H. Lissberger	*490 50
C. T. Raynolds & Co	497 00
U. S. White Lead Co	508 00
J. H. Walker	513 00
David Babcock & Co	536 00
George D. Putnam & Co.	539 50
A. W. Pratt & Co	549 50
S. C. Carll	623 00
C. A. Burgess	631 50

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* Accepted.

Class No. 63. Sperm and lard oil:

George D. Putnam & Co.	*$828 00
H. Lissberger	852 00
David Babcock & Co	864 00
U. S. White Lead Co	870 00
J. H. Walker	948 00
C. A. Burgess	960 00
S. C. Carll	990 00

Class No. 68. Glass:

E. F. Holbrook & Bros	*285 50
J. H. Walker	299 00
U. S. White Lead Co	314 00
George D. Putnam & Co.	335 00
S. C. Carll	439 00
C. A. Burgess	537 00

Class No. 69. Brushes:

H. Lissberger	*230 50
J. H. Walker	240 25
George D. Putnam & Co.	294 25
U. S. White Lead Co	355 30
C. A. Burgess	384 50
S. C. Carll	564 50

Class No. 70. Dry goods:

J. H. Walker	*410 76
H. Lissberger	430 49
Noblit, Brown, Noblit & Co	484 90
S. C. Carll	587 10

Class No. 71. Stationery:

Willis G. Myers	*287 70
William H. Dempsey	302 75
W. B. Buzzell & Son	331 25

Class No. 73. Ship-chandlery:

H. Lissberger	*179 50
George D. Putnam & Co.	244 50
S. C. Carll	257 25
J. H. Walker	266 00

Class No. 74. Acids:

H. Lissberger	*$90 00
U. S. White Lead Co	140 00
J. H. Walker	170 00
George D. Putnam & Co.	180 00
S. C. Carll	480 00

Class No. 77. Belting, &c.:

Stephen Ballard & Co	*223 57
George D. Putnam & Co.	223 80
J. H. Walker	245 30
H. Lissberger	263 00
William A. Torry & Co	266 95
S. C. Carll	495 00

Class No. 78. Leather:

Stephen Ballard & Co	*90 00
H. Lissberger	97 50
George D. Putnam & Co.	97 50
J. H. Walker	103 50
S. C. Carll	135 00

Class No. 85. Anthracite coal:

David Babcock & Co	*2,418 00
John Street & Co	2,610 00
C. E. Walker & Co	2,640 00
William K. Clampffer, jr.	2,664 00
Samuel G. French	2,844 00
George D. Putnam & Co.	3,360 00

Class No. 87. Bituminous coal:

David Babcock & Co	*2,440 00
Johnson Bros	2,445 00
Samuel G. French	2,445 00
John Street & Co	2,625 00
C. E. Walker & Co	2,650 00
George D. Putnam & Co.	3,500 00

Opened in presence of—
J. W. EASBY, *Chief of Bureau.*
H. A. GOLDSBOROUGH, *Chief Clerk.*
THOMAS J. LASIER, *Clerk.*

NAVY DEPPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR, *September* 25, 1877.

Offer to furnish material for the Navy under the advertisement of the Bureau of Construction and Repair of August 21, 1877, at the navy-yard, Boston, Mass.

Class No. 13. White-pine plank, boards:

Geo. D. Putnam & Co	*$2,791 00
A. A. McCullough	3,062 50
James & Abbott	3,085 00
John F. Quigley	3,195 00
Watson & Pittinger	3,350 00
John Trickey	3,375 00
Geo. C. Ludlam	3,385 00
Elisha H. Jewett	4,250 00
S. C. Carll	4,950 00

Class No. 15. White ash, elm, beech:

Geo. D. Putnam & Co	*$312 00
A. A. McCullough	360 00
Geo. C. Ludlam	360 00
Elisha H. Jewett	400 00
John Trickey	400 00
James & Abbott	432 00
Watson & Pittinger	440 00
S. C. Carll	480 00

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* Accepted.

Class No. 16. White-ash oars:

Geo. D. Putnam & Co	*$147	00
DeGrawn, Aymar & Co.	165	00
J. H. Walker	180	00
David Babcock & Co	187	50
Fred'k A. Southmayd	191	25
S. C. Carll	270	00

Class No. 18. Black walnut, &c.:

Elisha H. Jewett	*1,680	00
A. A. McCullough	2,305	00
James & Abbott	2,380	00
John Trickey	2,394	00
Geo. D. Putnam & Co	2,460	00
S. C. Carll	2,505	00
Watson & Pittinger	2,585	00
John F. Quigley	2,590	00
Geo. C. Ludlam	2,730	00

Class No. 25. Lignumvitæ:

H. Lissberger	*504	00
Geo. D. Putnam & Co	516	00
Elisha H. Jewett	540	00
J. H. Walker	544	00
John Trickey	545	00
David Babcock & Co	549	00
S. C. Carll	550	00

Class No. 35. Steel:

Geo. D. Putnam & Co	*1,154	15
David Babcock & Co	1,175	75
J. H. Walker	1,179	50
H. Lissberger	1,265	87
James D. Rowland	1,280	50
Midvale Steel Works	1,354	37
J. A. Caldwell	1,428	25
Henry B. Jackson	1,428	25
Bellah, Quigley & Co	1,526	75
Geo. Dunbar & Co	1,526	75
S. C. Carll	1,773	00

Class No. 38. Iron wrought-nails:

J. A. Caldwell	*13	80
J. H. Walker	14	70
Noblit, Brown, Noblit & Co	15	00
S. C. Carll	18	00
H. Lissberger	42	00
Bellah, Quigley & Co	66	00

Class No. 39. Iron cut nails:

Geo. D. Putnam & Co	*158	50
H. Lissberger	159	00
J. H. Walker	171	25
J. A. Caldwell	172	00
Bellah, Quigley & Co	177	00
Noblit, Brown, Noblit & Co	192	00
S. C. Carll	217	50

Class No. 42. Lead, pipe, sheet:

H. Lissberger	*585	00
Robt. Leitch & Sons	650	00
J. H. Walker	658	75
Geo. D. Putnam & Co	666	25
David Babcock & Co	$690	00
Bellah, Quigley & Co	700	00
George Dunbar & Co	750	00
J. A. Caldwell	750	00
James D. Rowland	800	00
S. C. Carll	800	00

Class No. 48. Locks, hinges, &c:

H. Lissberger	*334	35
J. H. Walker	500	82
George D. Putnam & Co.	510	20
S. C. Carll	768	80
J. W. Gaskill & Sons	750	77
J. A. Caldwell	944	50
Dell Noblit, jr	1,395	15

Class No. 49. Screws:

George D. Putnam & Co	*463	90
H. Lissberger	516	40
J. H. Walker	540	40
J. W. Gaskill & Sons	542	30
J. A. Caldwell	544	53
Bellah, Quigley & Co	558	45
Dell Noblit, jr	632	39
George Dunbar & Co	671	55
S. C. Carll	685	00

Class No. 50. Files:

J. H. Walker	*215	35
George D. Putnam & Co.	218	10
H. Lissberger	257	65
C. H. Wight	259	05
Dell Noblit, jr	275	90
J. W. Gaskill & Sons	286	15
Joseph J. Walton	286	85
Bellah, Quigley & Co	299	40
George Dunbar & Co	326	40
Isaac M. Walton	350	00
S. C. Carll	400	50
J. A. Caldwell	435	15

Class No. 52. Tools for ship stores:

H. Lissberger	*253	60
S. C. Carll	399	40
J. H. Walker	416	94
George D. Putnam & Co.	439	72
J. A. Caldwell	548	52

Class No. 53. Tools for yard use:

H. Lissberger	*2,990	25
George D. Putnam & Co.	3,311	20
J. H. Walker	3,794	17
J. A. Caldwell	3,826	60
George Dunbar & Co	4,034	23
S. C. Carll	4,311	90

Class No. 54. Hardware:

J. H. Walker	*433	77
H. Lissberger	436	13
George D. Putnam & Co.	448	20
J. A. Caldwell	556	21
S. C. Carll	944	86

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* Accepted.

Class No. 56. White lead:

H. Lissberger	*$1,065 00
J. H. Walker	1,087 50
Thomas S. Harrison	1,122 00
Bellah, Quigley & Co	1,125 00
George D. Putnam & Co	1,125 00
U. S. White Lead Co	1,140 00
C. T. Raynolds & Co	1,162 50
J. H. Baker	1,200 00
J. A. Caldwell	1,275 00
David Babcock & Co	1,275 00
S. C. Carll	1,350 00
George Dunbar & Co	1,425 00

Class No. 58. Colored paints:

George D. Putnam & Co.	*240 50
Thomas S. Harrison	243 90
J. H. Baker	258 00
J. H. Walker	263 13
H. Lissberger	265 50
C. T. Raynolds & Co	268 75
U. S. White Lead Co	272 00
David Babcock & Co	295 00
C. A. Burgess	302 12
Bellah, Quigley & Co	303 00
George Dunbar & Co	328 62
J. A. Caldwell	333 00
S. C. Carll	363 00

Class No. 59. Linseed oil:†

J. A. Caldwell	1,375 00
George D. Putnam & Co.	*1,375 00
H. Lissberger	1,450 00
David Babcock & Co	1,475 00
J. H. Walker	1,487 50
U. S. White Lead Co	1,500 00
C. T. Raynolds & Co	1,500 00
C. S. Wertsner	1,575 00
S. C. Carll	1,575 00
Bellah, Quigley & Co	1,625 00

Class No. 60. Varnish, &c.:

George D. Putnam & Co.	*1,025 00
J. H. Walker	1,028 00
C. T. Raynolds & Co	1,040 00
U. S. White Lead Co	1,055 00
A. W. Pratt & Co	1,072 00
J. A. Caldwell	1,080 00
David Babcock & Co	1,120 00
Bellah, Quigley & Co	1,120 00
C. A. Burgess	1,145 00
H. Lissberger	1,146 00
C. S. Wertsner	1,325 00
S. C. Carll	1,650 00

Class No. 63. Sperm and lard-oil:

Geo. D. Putnam & Co	*516 00
U. S. White Lead Co	560 00
J. A. Caldwell	560 00
David Babcock & Co	564 00
H. Lissberger	576 00
J. H. Walker	620 00
C. A. Burgess	640 00
S. C. Carll	640 00

Class No. 64. Tallow, soap:

Geo. D. Putnam & Co	*$134 00
J. H. Walker	141 50
H. Lissberger	150 00
David Babcock & Co	150 00
Geo. Dunbar & Co	161 25
J. A. Caldwell	163 75
S. C. Carll	172 00

Class No. 68. Glass:

Geo. D. Putnam & Co	*193 31
E. F. Holbrook & Bros	205 68
J. H. Walker	211 22
Bellah, Quigley & Co	212 79
U. S. White Lead Co	229 70
C. S. Wertsner	263 71
J. A. Caldwell	284 63
H. Lissberger	354 75
S. C. Carll	366 89
C. A. Burgess	390 23

Class No. 69. Brushes:

Geo. D. Putnam & Co	*517 75
J. H. Walker	517 80
H. Lissberger	606 75
C. S. Wertsner	723 60
J. A. Caldwell	869 06
U. S. White Lead Co	882 50
Geo. Dunbar & Co	1,028 63
J. H. Baker	1,069 80
S. C. Carll	1,099 50

Class No. 70. Dry goods:

J. H. Walker	*488 30
Geo. Dunbar & Co	533 37
S. C. Carll	624 25
Noblit, Brown, Noblit & Co	666 45
J. A. Caldwell	857 30

Class No. 1. Stationery:

William H. Dempsey	*353 22
J. A. Caldwell	428 09

Class No. 73. Ship-chandlery:

J. A. Caldwell	*383 50
George D. Putnam & Co.	433 75
J. H. Walker	452 00
H. Lissberger	475 50
George Dunbar & Co	556 00

Class No. 74. Acids:

H. Lissberger	*40 00
J. A. Caldwell	42 50
U. S. White Lead Co	50 00
George D. Putnam & Co.	60 00
J. H. Walker	65 00
S. C. Carll	200 00

Class No. 75. Rosin, pitch, &c.:

H. Lissberger	*87 50
J. A. Caldwell	137 50
J. H. Walker	147 50
S. C. Carll	150 00
George D. Putnam & Co.	162 50

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* Accepted.

† Decided by lot.

Class No. 77. Belting, packing:

J. A. Caldwell	*$2,263 94
George D. Putnam & Co.	2,425 34
J. H. Walker	2,472 32
H. Lissberger	2,537 93
Stephen Ballard & Co.	2,775 42
George Dunbar & Co.	2,887 02
William A. Torry & Co.	2,914 93
Isaac M. Walton	3,185 14
S. C. Carll	4,069 87

Class No. 78. Leather:

J. H. Walker	*10 80
J. A. Caldwell	14 25
George Dunbar & Co.	14 25
H. Lissberger	$15 75
S. C. Carll	21 00
J. H. Baker	36 60

Class No. 85. Anthracite coal:

David Babcock & Co.	*2,418 00
John Street & Co.	2,550 00
William K. Clampffer, jr.	2,574 00
Samuel G. French	2,664 00
George D. Putnam & Co.	2,820 00

Class No. 88. Charcoal, coke:

David Babcock & Co.	*117 00
George D. Putnam & Co.	132 00
J. H. Walker	144 00

Opened in presence of—
J. W. Easby, *Chief of Bureau.*
H. A. Goldsborough, *Chief Clerk.*
Thomas J. Lasier, *Clerk.*
Navy Department,
Bureau of Construction and Repair, *September* 25, 1877.

Offer to furnish material for the Navy, under the advertisement of the Bureau of Construction and Repair, of August 21, 1877, *at the navy-yard, New York.*

Class No. 9. Yellow-pine mast-timber:

S. C. Carll	*$12,228 00
William White	12,717 12
A. A. McCullough	20,380 00
Watson & Pittinger	22,825 60
James & Abbott	24,129 92
George T. Wallace	26,738 56

Class No. 16. White-ash oars:

George H. Creed	*660 00
DeGrawn, Aymer & Co.	750 00
J. H. Walker	825 00
David Babcock & Co.	862 50
Frederick A. Southmayd.	918 75
S. C. Carll	1,275 00
Robert J. Neeley	1,950 00
Watson & Pittinger	2,250 00

Class No. 22. Cypress, cedar:

Watson & Pittinger	*800 00
James & Abbott	830 00
George T. Wallace	900 00
A. A. McCullough	950 00
Robert J. Neeley	970 00
S. C. Carll	1,400 00

Class No. 23. Black spruce:

J. W. Gaskill & Sons	*2,587 95
Watson & Pittinger	3,470 00
David Babcock & Co.	4,168 00
James & Abbott	4,358 00
George A. Hammond	5,000 00

Class No. 32. Wrought iron, round and square:

George H. Creed	*$1,580 00
Bellah, Quigley & Co.	1,700 00
H. Lissberger	1,735 00
J. H. Walker	1,912 50
S. C. Carll	3,300 00

Class No. 37. Iron spikes:

Dell Noblit, jr	*416 00
J. H. Walker	478 40
H. Lissberger	480 00
George H. Creed	496 00
David Babcock & Co.	540 00
S. C. Carll	560 00

Class No. 42. Lead, pipe, sheet:

H. Lissberger	*1,521 00
George H. Creed	1,605 00
David Babcock & Co.	1,617 50
J. H. Walker	1,657 50
Robert Leitch & Sons	1,690 00
Bellah, Quigley & Co.	1,755 00
S. C. Carll	1,950 00
James D. Rowland	2,080 00

Class No. 43. Zinc:

J. H. Walker	*575 00
George H. Creed	580 00
H. Lissberger	587 50
David Babcock & Co.	590 00
Bellah, Quigley & Co.	650 00
James D. Rowland	750 00
S. C. Carll	775 00

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* Accepted.

Class No. 44. Tin:

George H. Creed	*$1,640 00
H. Lissberger	1,675 00
David Babcock & Co	1,725 00
J. H. Walker	2,000 00
S. C. Carll	2,000 00
Bellah, Quigley & Co	2,050 00
James D. Rowland	2,200 00

Class No. 48. Locks, hinges, &c:

H. Lissberger	*256 50
J. H. Walker	280 50
George H. Creed	363 00
J. W. Gaskill & Sons	482 70
Dell Noblit, jr	1,249 20
S. C. Carll	1,425 00

Class No. 49. Screws:

George H. Creed	*279 20
Dell Noblit, jr	353 52
S. C. Carll	354 20
H. Lissberger	364 40
J. H. Walker	372 10
Bellah, Quigley & Co	397 90
J. W. Gaskill & Sons	400 40

Class No. 50. Files:

George H. Creed	*617 50
J. H. Walker	726 10
Joseph J. Walton	766 70
C. H. Wight	826 10
H. Lissberger	838 20
Dell Noblit, jr	880 40
Bellah, Quigley & Co	927 40
J. W. Gaskill & Sons	949 50
Isaac M. Walton	1,123 00
S. C. Carll	1,430 00

Class No. 51. Augers:

H. Lissberger	*165 00
J. H. Walker	242 50
George H. Creed	256 00
Noblit, Brown, Noblit & Co	295 00
S. C. Carll	465 00

Class No. 52. Tools for ship-stores:

H. Lissberger	*818 75
George H. Creed	915 00
J. H. Walker	1,038 10
David Babcock & Co	1,186 90
S. C. Carll	1,430 10

Class No. 53. Tools for yard use:

George H. Creed	*980 00
David Babcock & Co	1,089 20
H. Lissberger	1,126 00
J. H. Walker	1,170 38
Joseph J. Walton	1,174 20
Noblit, Brown, Noblit & Co	$1,523 24
Isaac M. Walton	1,952 00
S. C. Carll	2,162 00

Class No. 54. Hardware:

George H. Creed	*1,103 70
J. H. Walker	1,253 37
H. Lissberger	1,641 75
David Babcock & Co	1,720 55
S. C. Carll	3,271 50

Class No. 56. White lead:

H. Lissberger	*2,150 00
George H. Creed	2,170 00
Thomas S. Harrison	2,219 00
George H. Burnett	2,250 00
Bellah, Quigley & Co	2,287 50
J. H. Walker	2,312 50
U. S. White Lead Co	2,340 00
C. T. Raynolds & Co	2,400 00
David Babcock & Co	2,495 00
Joseph J. Walton	2,500 00
S. C. Carll	2,750 00

Class No. 57. Zinc paints:

George H. Creed	*498 00
C. T. Raynolds & Co	550 00
J. H. Walker	550 00
Thomas S. Harrison	580 00
H. Lissberger	600 00
Joseph J. Walton	600 00
U. S. White Lead Co	625 00
David Babcock & Co	650 00
Bellah, Quigley & Co	662 50
S. C. Carll	775 00

Class No. 58. Colored paints: †

Class No. 59. Linseed oil:

George H. Creed	*2,112 00
H. Lissberger	2,280 00
J. H. Walker	2,340 00
David Babcock & Co	2,360 00
S. C. Carll	2,360 00
C. T. Raynolds & Co	2,400 00
U. S. White Lead Co	2,400 00

Class No. 60. Varnish, &c.: †

Class No. 63. Sperm and lard oil:

George H. Creed	*1,190 00
David Babcock & Co	1,290 00
H. Lissberger	1,400 00
U. S. White Lead Co	1,400 00
J. H. Walker	1,530 00
S. C. Carll	1,550 00

Class No. 64. Tallow, soap:

George H. Creed	*135 00
H. Lissberger	140 00
J. H. Walker	149 50
David Babcock & Co	161 00
S. C. Carll	185 0

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* Accepted.

† Class not awarded.

Class No. 68. Glass:

George H. Creed	*$234 50
E. F. Holbrook & Bros	283 75
J. H. Walker	296 00
Bellah, Quigley & Co	298 50
U. S. White Lead Co	307 50
Walton Brothers	320 95
Edward A. Bond	329 20
S. C. Carll	550 50
H. Lissberger	720 00

Class No. 69. Brushes:

George H. Creed	*512 50
J. H. Walker	597 00
C. S. Wertsner	710 00
David Babcock & Co	840 00
Bellah, Quigley & Co	855 00
U. S. White Lead Co	922 50
S. C. Carll	980 00

Class No. 70. Dry goods:

H. Lissberger	*420 40
George H. Creed	459 00
J. H. Walker	607 00
S. C. Carll	868 00
Noblit, Brown, Noblit & Co	876 80

Class No. 71. Stationery:

William H. Dempsey	*223 58
Arthur & Bonnell	283 35

Class No. 72. Crucibles:

George H. Creed	*155 00
J. H. Walker	155 44
Joseph J. Walton	174 00
Dell Noblit, jr	188 50
H. Lissberger	188 50
David Babcock & Co	197 75
Isaac M. Walton	232 00

Class No. 73. Ship-chandlery:

George H. Creed	*$1,558 30
J. H. Walker	1,819 50
H. Lissberger	1,867 40
David Babcock & Co	1,957 50

Class No. 74. Acids:

George H. Creed	*30 00
H. Lissburger	32 50
U. S. White Lead Co	37 50
J. H. Walker	43 12
David Babcock & Co	53 75
S. C. Carll	150 00

Class No. 77. Belting, packing:

H. Lissberger	*108 00
George H. Creed	137 50
Stephen Ballard & Co	192 00
J. H. Walker	216 00
Isaac M. Walton	240 00
William A. Torrey & Co.	336 00
S. C. Carll	420 00

Class No. 78. Leather:

H. Lissberger	*79 50
J. H. Walker	80 00
George H. Creed	87 50
Isaac M. Walton	97 50
S. C. Carll	105 00

Class No. 80. Junk: †

Class No. 85. Anthracite coal:

David Babcock & Co	*4,071 00
George H. Creed	4,164 50
John Street & Co	4,637 50
Samuel G. French	4,925 00
J. H. Walker	5,002 50

Opened in presence of—
J. W. Easby, *Chief of Bureau.*
H. A. Goldsborough, *Chief Clerk.*
Thomas J. Lasier, *Clerk.*

Navy Department,
Bureau of Construction and Repair, *September* 25, 1877.

Offer to furnish material for the Navy under the advertisement of the Bureau of Construction and Repair, of August 21, 1877, *at the navy-yard, League Island.*

Class No. 9. Yellow-pine mast timber:

S. C. Carll	*$1,688 25
William White	1,800 80
A. A. McCullough	2,813 75
George T. Wallace	3,691 64

Class No. 18. Black walnut, &c.:

A. A. McCullough	*1,230 00
George C. Ludlam	1,315 00
S. C. Carll	1,465 00
J. W. Gaskill & Sons	1,505 00
Watson & Pittinger	1,630 00

Class No. 23. Black Spruce:

J. W. Gaskill & Sons	*$497 25
Watson & Pittinger	758 00
David Babcock & Co	1,019 50
James & Abbott	1,195 00

Class No. 25. Lignum-vitæ:

H. Lissberger	*902 00
David Babcock & Co	908 00
J. H. Walker	1,007 00
S. C. Carll	1,050 00
Watson & Pittinger	1,280 00
James & Abbott	1,298 00

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* Accepted. † Class not awarded.

Class No 34. Iron, plate:

H. Lissberger	*$419 60
J. H. Walker	466 15
J. W. Gaskill & Sons	816 67
J. B. Shannon	900 22

Class No. 38. Iron wrought nails:

Noblit, Brown, Noblit & Co	*47 05
J. W. Gaskill & Sons	47 60
J. H. Walker	49 00
Jacob B. Shannon	118 00
H. Lissberger	132 00
Paul J. Field	146 00
Bellah, Quigley & Co	220 00

Class No. 39. Iron cut nails:†

Noblit, Brown, Noblit & Co	*165 30
J. W. Gaskill & Sons	165 30
Paul J. Field	181 00
J. B. Shannon	184 26
H. Lissberger	187 80
Bellah, Quigley & Co	190 24
J. H. Walker	210 70

Class No. 42. Lead, pipe, sheet:

Tatham Brothers	*2, 182 40
Robert Leitch & Sons	2, 410 00
Bellah, Quigley & Co	2, 430 00
H. Lissberger	2, 498 00
Paul J. Field	2, 565 00
J. H. Walker	2, 570 00
J. B. Shannon	2, 708 00
J. W. Gaskill & Sons	2, 742 65
David Babcock & Co	2, 780 00
S. C. Carll	2, 840 00
James D. Rowland	3, 160 00

Class No. 43. Zinc:

H. Lissberger	*62 00
J. B. Shannon	63 92
Bellah, Quigley & Co	64 00
J. W. Gaskill & Sons	66 00
Paul J. Field	68 00
J. H. Walker	68 00
David Babcock & Co	72 00
James D. Rowland	76 00
S. C. Carll	80 00

Class No. 48. Locks, hinges, &c.:

J. H. Walker	*706 36
H. Lissberger	756 39
Dell Noblit, jr	1, 109 31
Paul J. Field	1, 206 62
J. B. Shannon	1, 424 31
J. W. Gaskill & Sons	1, 444 77
S. C. Carll	1, 658 75

Class No. 49. Screws:

Dell Noblit, jr	*335 89
J. W. Gaskill & Sons	338 84
H. Lissberger	347 10
J. H. Walker	348 93
Paul J. Field	$376 24
Bellah, Quigley & Co	369 09
S. C. Carll	387 24
J. B. Shannon	407 87

Class No. 50. Files:

J. H. Walker	*568 07
C. H. Wight	680 75
H. Lissberger	715 16
J. B. Shannon	730 09
Dell Noblit, jr	733 41
Bellah, Quigley & Co	760 61
Paul J. Field	765 84
J. W. Gaskill & Sons	778 57
S. C. Carll	1, 130 45

Class No. 52. Tools for ship's stores:

H. Lissberger	*40 20
J. H. Walker	44 34
J. B. Shannon	46 26
J. W. Gaskill & Sons	59 56
Noblit, Brown, Noblit & Co	60 36
Bellah, Quigley & Co	62 76
Paul J. Field	63 60
S. C. Carll	120 30

Class No. 53. Tools for yard use:

J. H. Walker	*477 63
J. B. Shannon	495 01
H. Lissberger	527 06
J. W. Gaskill & Sons	628 34
Paul J. Field	629 03
S. C. Carll	853 55

Class No. 54. Hardware:

H. Lissberger	(‡)
J. H. Walker	*1 410 07
J. W. Gaskill & Sons	1, 851 52
J. B. Shannon	1, 888 18
Noblit, Brown, Noblit & Co	2, 156 27
Paul J. Field	2, 521 60
S. C. Carll	2, 896 55

Class No. 56. White lead:

H. Lissberger	*365 00
Thomas S. Harrison	386 50
Bellah, Quigley & Co	403 12
United States White Lead Company	410 00
J. B. Shannon	424 50
C. T. Raynolds & Co	425 00
J. W. Gaskill & Sons	430 00
J. H. Walker	437 50
Robert Leitch & Sons	437 50
Joseph J. Walton	450 00
William Waterall & Co	462 50
Edward C. Street	475 00
David Babcock & Co	495 00
S. C. Carll	500 00

Class No. 58. Colored paints:

Thomas S. Harrison	*455 15
J. H. Walker	493 32
United States White Lead Company	530 65
J. B. Shannon	530 70

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* Accepted. † Decided by lot. ‡ Informal.

C. S. Wertsner	$543 50
David Babcock & Co	552 30
C. T. Raynolds & Co	582 15
Bellah, Quigley & Co	623 70
Joseph J. Walton	639 50
J. W. Gaskill & Sons	652 32
Edward C. Street	694 80
H. Lissberger	704 35
William Waterall & Co	718 50
S. C. Carll	869 50

Class No. 60. Varnish, &c.:

H. Lissberger	*423 00
United States White Lead Company	441 00
C. T. Raynolds & Co	447 00
J. H. Walker	454 50
J. B. Shannon	459 00
S. C. Carll	468 00
Bellah, Quigley & Co	478 50
David Babcock & Co	478 50
J. W. Gaskill & Sons	484 50

Class No. 63. Sperm and lard oil:

J. B. Shannon	*260 00
Edward C. Street	274 00
H. Lissberger	280 00
United States White Lead Company	280 00
David Babcock & Co	298 00
J. H. Walker	312 00
C. T. Raynolds & Co	320 00
S. C. Carll	320 00

Class No. 64. Tallow, soaps:

H. Lissberger	*12 00
J. H. Walker	12 75
J. B. Shannon	13 50
Paul J. Field	21 50
S. C. Carll	24 00

Class No. 69. Brushes:

H. Lissberger	*29 25
J. H. Walker	32 50
Paul J. Field	67 00
S. C. Carll	80 00
J. B. Shannon	82 50
United States White Lead Company	149 00

Class No. 70. Dry-goods:

J. B. Shannon	*$434 80
J. H. Walker	463 15
H. Lissberger	472 40
Noblit, Brown, Noblit & Co	699 75
S. C. Carll	758 20

Class No. 71. Stationery:

J. B. Shannon	*335 55
Walstron & Stevens	488 25
William H. Dempsey	788 60

Class No. 73. Ship-chandlery.:

J. B. Shannon	*159 95
H. Lissberger	164 35
J. H. Walker	172 45
Paul J. Field	224 95
S. C. Carll	235 60

Class No. 75. Rosin, pitch, &c.:

H. Lissberger	*145 00
J. H. Walker	202 00
S. C. Carll	215 00
United States White-Lead Company	215 00
J. B. Shannon	220 00
Edward C. Street	230 00

Class No. 78. Leather:

J. H. Walker	*374 40
H. Lissberger	434 65
J. B. Shannon	480 15
S. C. Carll	579 50

Class No. 85. Anthracite coal:

David Babcock & Co	*1,136 25
Samuel G. French	1,361 25
William K. Clampffer, jr.	1,387 50

Class No. 87. Bituminous Coal.

John Street & Co	*585 00
Johnson Bros	589 50
Samuel G. French	666 00

Class No. 88. Charcoal, coke:

Paul J. Field	*95 00
J. H. Walker	122 50
J. B. Shannon	135 00

Opened in presence of—
J. W. Easby, *Chief of Bureau.*
H. A. Goldsborough, *Chief Clerk.*
Thomas J. Lasier, *Clerk.*

Navy Department,
Bureau of Construction and Repair, *September* 25, 1877.

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* Accepted.

Offer to furnish material for the Navy under the advertisement of the Bureau of Construction and Repair of August 21, 1877, *at the navy-yard, Washington.*

Class No. 39. Yellow-pine mast-timber.

S. C. Carll	*$2,165	25
William White	2,309	60
A. A. McCullough	3,608	75
James & Abbott	4,272	76
George T. Wallace	4,734	68

Class No. 22. Cypress, cedar:

Watson & Pittinger	*795	00
George T. Wallace	800	00
A. A. McCullough	825	00
James & Abbott	835	00
Robert J. Neely	960	00
S. C. Carll	1,400	00

Class No. 23. Black spruce:

J. W. Gaskill & Sons	*495	96
Watson & Pittinger	674	00
David Babcock & Co	839	50

Class No. 32. Wrought iron, round and square.

George P. Goff	*77	90
J. W. Gaskill & Sons	89	31
H. Lissberger	99	25
Bellah, Quigley & Co	104	00
J. H. Walker	113	50
S. C. Carll	205	00

Class No. 39. Iron cut-nails:

H. Lissberger	*12	00
George P. Goff	13	00
Noblit, Brown, Noblit & Co	13	75
Bellah, Quigley & Co	16	25
J. H. Walker	20	00
J. W. Gaskill & Sons	20	00
S. C. Carll	20	00

Class No. 44. Tin:

H. Lissberger	*405	50
Bellah, Quigley & Co	418	00
J. H. Walker	434	92
J. W. Gaskill & Sons	436	00
David Babcock & Co	448	00
James D. Rowland	458	00
George P. Goff	470	00
S. C. Carll	488	00

Class No. 48. Locks, hinges, &c.:

H. Lissberger	*41	60
George P. Goff	52	80
J. H. Walker	62	00
Dell Noblit, jr	76	00
J. W. Gaskill & Sons	159	56
S. C. Carll	296	00

Class No. 49. Screws:

George P. Goff	*$199	64
Dell Noblit, jr	206	04
H. Lissberger	208	97
J. H. Walker	209	88
Bellah, Quigley & Co	231	62
J. W. Gaskill & Sons	237	15
S. C. Carll	240	03

Class No. 50. Files:

H. Lissberger	*14	28
C. H. Wight	15	96
J. H. Walker	16	66
J. W. Gaskill & Sons	16	68
George P. Goff	17	32
Dell Noblit, jr.	20	12
Bellah, Quigley & Co	23	98
S. C. Carll	31	24

Class No. 51. Augers:

H. Lissberger	*53	00
J. H. Walker	208	42
George P. Goff	211	18
Noblit, Brown, Noblit & Co	238	00
J. W. Gaskill & Sons	251	78
S. C. Carll	311	00

Class No. 52. Tools for ship's stores:

H. Lissberger	*71	00
George P. Goff	73	45
S. C. Carll	89	00
J. W. Gaskill & Sons	144	87
J. H. Walker	314	80

Class No. 53. Tools for yard use:

S. C. Carll	*64	56
H. Lissberger	83	70
J. H. Walker	224	46
J. W. Gaskill & Sons	275	37

Class No. 54. Hardware:

H. Lissberger	*301	78
J. H. Walker	449	70
S. C. Carll	566	96
J. W. Gaskill & Sons	758	25.

Class No. 56. White lead:

H. Lissberger	*584	00
Thomas S. Harrison	616	30
George P. Goff	620	00
C. S. Wertsner	660	00
Bellah, Quigley & Co	670	00
C. T. Raynolds & Co	680	00
U. S. White Lead Co	680	00
Robert Leitch & Sons	700	00

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* Accepted.

Francis Gudgin	$720 00
J. H. Walker	720 00
Joseph J. Walton	720 00
J. W. Gaskill & Sons	736 00
David Babcock & Co	840 00
S. C. Carll	840 00

Class No. 57. Zinc paints:

H. Lissberger	*260 00
Thomas S. Harrison	279 20
C. T. Raynolds & Co	280 00
Robert Leitch & Sons	300 00
Joseph J. Walton	320 00
C. S. Wertsner	340 00
J. H. Walker	340 00
U. S. White Lead Co	340 00
George P. Goff	350 00
Francis Gudgin	360 00
J. W. Gaskill & Sons	360 00
Bellah, Quigley & Co	365 06
David Babcock & Co	380 00
S. C. Carll	380 00

Class No. 58. Colored paints:

C. T. Raynolds & Co	*60 30
C. S. Wertsner	66 40
David Babcock & Co	68 30
Thomas S. Harrison	69 75
Bellah, Quigley & Co	69 85
H. Lissberger	74 05
U. S. White Lead Co	76 17
J. H. Walker	79 16
J. W. Gaskill & Sons	85 56
Francis Gudgin	101 50
Joseph J. Walton	102 40
S. C. Carll	136 05

Class No. 59. Linseed-oil:

H. Lissberger	*570 00
C. T. Raynolds & Co	600 00
U. S. White Lead Co	600 00
C. S. Wertsner	610 00
David Babcock & Co	610 00
J. W. Gaskill & Sons	610 00
Francis Gudgin	620 00
J. H. Walker	630 00
Bellah, Quigley & Co	650 00
S. C. Carll	650 00

Class No. 60. Varnish, &c.:

C. T. Raynolds & Co	*443 75
U. S. White Lead Co	474 20
J. H. Walker	477 50
A. W. Pratt & Co	500 90
David Babcock & Co	507 95
Bellah, Quigley & Co	510 20
J. W. Gaskill & Sons	513 29
C. S. Wertsner	541 80
Francis Gudgin	569 90
S. C. Carll	768 00
H. Lissberger	955 54

Class No. 63. Sperm and lard oil:

H. Lissberger	*420 00
David Babcock & Co	446 00
C. S. Wertsner	450 00
U. S. White Lead Co	$456 00
J. H. Walker	460 00
S. C. Carll	510 00
Francis Gudgin	530 00

Class No. 64. Tallow, soap: †

C. S. Wertsner	*3 60
H. Lissberger	3 60
J. H. Walker	4 50
Francis Gudgin	7 50
S. C. Carll	9 00

Class No. 68. Glass:

E. F. Holbrook & Bros	*335 27
H. Lissberger	345 25
U. S. White Lead Co	372 38
J. H. Walker	377 30
Francis Gudgin	390 25
Bellah, Quigley & Co	431 25
J. W. Gaskill & Sons	542 95
George P. Goff	577 00
S. C. Carll	639 60

Class No. 65. Brushes:

H. Lissberger	*212 50
J. H. Walker	279 27
C. S. Wertsner	314 75
Bellah, Quigley & Co	358 00
George P. Goff	365 40
U. S. White Lead Co	378 35
Francis Gudgin	419 00
S. C. Carll	566 00

Class No. 70. Dry goods:

J. H. Walker	*120 75
H. Lissberger	126 10
Noblit, Brown, Noblit & Co	174 10
George P. Goff	196 00
S. C. Carll	218 75

Class No. 71. Stationery:

Solomons & Chapman	*133 20
William H. Dempsey	428 88

Class No. 72. Crucibles:

J. H. Walker	*80 40
Joseph J. Walton	90 00
Dell Noblit, jr	97 50
H. Lissberger	97 50
J. W. Gaskill & Sons	105 00
David Babcock & Co	127 50

Class No. 73. Ship-chandlery:

H. Lissberger	*188 90
J. H. Walker	210 60
S. C. Carll	277 50

Class No. 74. Acids:

H. Lissberger	*6 75
U. S. White-Lead Co	10 50
J. H. Walker	45 00
S. C. Carll	75 00

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* Accepted.

† Decided by lot.

Class No. 75. Rosin, pitch, &c.:

H. Lissberger	*$57 50
J. H. Walker	60 50
U. S. White-Lead Co	64 50
S. C. Carll	80 00

Class No. 77. Belting, packing

J. H. Walker	*419 15
H. Lissberger	451 25
William A. Torrey & Co.	468 20
Stephen Ballard & Co	476 75
George P. Goff	584 50
S. C. Carll	697 05

Class No. 78. Leather:

Stephen Ballard & Co	*28 80
H. Lissberger	31 20
J. H. Walker	33 12
S. C. Carll	43 20

Class No. 87. Bituminous coal:

Johnson Brothers	*$4,485 00
L. William Guinaud	4,500 00
Riley & Sons	4,605 00
Samuel G. French	5,550 00

Class No. 88. Charcoal, coke:

Johnson Brothers	*55 00
William T. Clark	62 50
J. H. Walker	122 50

Class No. 89. Wood:

L. William Guinaud	*85 20
Johnson Brothers	102 90
Riley & Sons	162 90

Opened in presence of—
J. W. EASBY, *Chief of Bureau.*
H. A. GOLDSBOROUGH, *Chief Clerk.*
THOMAS J. LASIER, *Clerk.*

NAVY DEPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR, *September* 25, 1877.

Offer to furnish material for the Navy under the advertisement of the Bureau of Construction and Repair of August 21, 1877, *at the navy-yard, Norfolk.*

Class No. 9. Yellow-pine mast timber:

William White	*$1,992 08
S. C. Carll	2,692 00
James & Abbott	3,338 08
A. A. McCullough	3,365 00
George T. Wallace	4,011 08

Class No. 13. White-pine plank, boards:

A. A. McCullough	*4,315 00
S. C. Carll	4,465 00
J. W. Gaskill & Sons	4,563 00
Robert J. Neely	4,660 00
James & Abbott	4,882 50
George C. Ludlam	4,982 00
Watson & Pittinger	5,020 00
John F. Quigley	5,194 00
Thomas W. Smith	5,379 00

Class No. 15. White ash, elm, beech:

A. A. McCullough	*507 50
Robert J. Neely	607 50
George C. Ludlam	642 50
J. W. Gaskill & Sons	654 50
S. C. Carll	675 00
Watson & Pittinger	722 50
James Fentress	810 00

Class No. 16. White ash oars:

George P. Goff	*$585 37
De Grauw, Aymar & Co.	613 25
J. H. Walker	641 12
Frederick A. Southmayd	710 79
David Babcock & Co	787 00
E. V. White & Co	874 25
S. C. Carll	937 50
James Fentress	1,141 00
Robert J. Neely	1,338 00

Class No. 18. Black walnut, &c.:

A. A. McCullough	*992 50
Robert J. Neely	1,062 50
S. C. Carll	1,080 00
J. W. Gaskill & Sons	1,125 50
Watson & Pittinger	1,187 50
James & Abbott	1,198 50
James Fentress	1,500 00
George C. Ludlam	1,690 00

Class No. 22. Cypress, cedar:†

George T. Wallace	*135 00
A. A. McCullough	135 00
Watson & Pittinger	142 50
Robert J. Neely	147 00
S. C. Carll	210 00

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* Accepted.

† Decided by lot.

Class No. 25. Lignum-vitæ:

J. H. Walker	*$250 00
H. Lissberger	260 00
David Babcock & Co	278 00
S. C. Carll	280 00

Class No. 32. Wrought iron, round and square:

H. Lissberger	*1,153 20
George P. Goff	1,189 10
J. W. Gaskill & Sons	1,193 96
E. V. White & Co	1,217 75
Bellah, Quigley & Co	1,269 40
Taylor, Elliot & Waters	1,295 25
J. H. Walker	1,298 00
S. C. Carll	1,669 00

Class No. 33. Wrought iron, flat:

George P. Goff	*459 02
J. W. Gaskill & Sons	459 79
H. Lissberger	503 47
Bellah, Quigley & Co	519 60
Taylor, Elliot & Waters	527 27
J. H. Walker	558 41
S. C. Carll	829 70

Class No. 34. Iron, plate:

H. Lissberger	*241 00
J. W. Gaskill & Sons	269 60
Bellah, Quigley & Co	273 50
J. H. Walker	317 75

Class No. 35. Steel:

David Babcock & Co	*840 25
Bellah, Quigley & Co	846 00
J. H. Walker	901 38
George P. Goff	916 50
James D. Rowland	916 50
H. Lissberger	938 87
Midvale Steel Works	969 37
J. W. Gaskill & Sons	1,047 65
E. V. White & Co	1,082 25
S. C. Carll	1,265 00

Class No. 37. Iron spikes:

Dell Noblit, jr	*402 30
J. W. Gaskill & Sons	430 61
H. Lissberger	447 00
Bellah, Quigley & Co	453 20
J. H. Walker	525 50
George P. Goff	587 06
Taylor, Elliot & Waters	588 50
S. C. Carll	593 00
David Babcock & Co	612 50
E. V. White & Co	968 50

Class No. 39. Iron cut nails:

George P. Goff	*167 50
H. Lissberger	171 00
J. H. Walker	176 25
Taylor, Elliot & Waters	184 50
Bellah, Quigley & Co	194 50
J. W. Gaskill & Sons	204 15
Noblit, Brown, Noblit & Co	211 25
S. C. Carll	229 50
E. V. White & Co	239 25

Class No. 44. Tin:

George P. Goff	*$95 52
H. Lissberger	97 50
S. C. Carll	105 00
Robert Leitch & Sons	105 75
J. W. Gaskill & Sons	106 71
J. H. Walker	112 50
Bellah, Quigley & Co	114 00
David Babcock & Co	117 00

Class No. 48. Locks, hinges, &c.:

H. Lissberger	*442 50
J. H. Walker	560 50
George P. Goff	575 00
Dell Noblit, jr	631 18
J. W. Gaskill & Sons	665 06
S. C. Carll	671 45

Class No. 49. Screws:

Dell Noblit, jr	*477 10
S. C. Carll	493 48
J. H. Walker	499 42
J. W. Gaskill & Sons	507 74
Bellah, Quigley & Co	516 44
H. Lissberger	529 82
Taylor, Elliot & Waters	544 73
E. V. White & Co	559 60

Class No. 50. Files:

J. H. Walker	*379 98
George P. Goff	426 27
Joseph J. Walton	434 65
C. H. Wight	456 34
H. Lissberger	473 26
Bellah, Quigley & Co	526 23
Dell Noblit, jr	527 90
J. W. Gaskill & Sons	561 83
S. C. Carll	579 71

Class No. 52. Tools for ships' stores:

H. Lissberger	*1,013 45
J. H. Walker	1,539 13
J. W. Gaskill & Sons	2,043 01
S. C. Carll	2,263 20

Class No. 53. Tools for yard use:

H. Lissberger	*1,032 15
S. C. Carll	2,325 55
J. W. Gaskill & Sons	2,722 30
J. H. Walker	2,818 70

Class No. 54. Hardware:

J. H. Walker	*1,275 64
H. Lissberger	1,400 13
J. W. Gaskill & Sons	1,713 28
S. C. Carll	2,379 60

Class No. 56. White lead:

H. Lissberger	*1,148 00
George H. Burnett	1,205 00
Bellah, Quigley & Co	1,225 00

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*Accepted.

Thomas S. Harrison	$1,228 40
John Curtlett	1,237 50
C. T. Raynolds & Co	1,285 00
U. S. White Lead Co	1,300 00
J. H. Walker	1,340 00
Joseph J. Walton	1,340 00
Robert Leitch & Sons	1,350 00
George P. Goff	1,352 50
J. W. Gaskill & Sons	1,380 00
E. V. White & Co	1,380 00
David Babcock & Co	1,485 00
S. C. Carll	1,500 00

Class No. 57. Zinc paints:

H. Lissberger	*505 00
C. T. Raynolds & Co	515 00
Thomas S. Harrison	528 40
Robert Leitch & Sons	570 00
Joseph J. Walton	595 00
J. H. Walker	600 00
U. S. White Lead Co	620 00
Bellah, Quigley & Co	642 50
George P. Goff	650 00
J. W. Gaskill & Sons	660 00
David Babcock & Co	682 50
S. C. Carll	690 00
E. V. White & Co	705 00
C. A. Burgess	730 00

Class No. 58. Colored paints:

C. T. Raynolds & Co	*890 47
Joseph J. Walton	908 00
J. H. Walker	936 00
David Babcock & Co	947 75
C. S. Wertsner	991 05
Bellah, Quigley & Co	998 00
Thomas S. Harrison	1,050 50
J. W. Gaskill & Sons	1,076 66
H. Lissberger	1,123 10
U. S. White Lead Co	1,221 17
E. V. White & Co	1,451 47
C. A. Burgess & Co	1,629 85
S. C. Carll	1,876 25

Class No. 59. Linseed-oil:

H. Lissberger	*1,488 00
C. T. Raynolds & Co	1,500 00
U. S. White Lead Co	1,536 00
J. H. Walker	1,548 00
C. S. Wertsner	1,560 00
David Babcock & Co	1,572 00
J. W. Gaskill & Sons	1,584 00
S. C. Carll	1,596 00
Bellah, Quigley & Co	1,620 00

Class No. 60. Varnish, &c.:†

Class No. 63. Sperm and lard oil:

David Babcock & Co	*682 00
J. H. Walker	692 00

H. Lissberger	$693 00
U. S. White Lead Co	713 00
S. C. Carll	746 00
C. A. Burgess	850 00

Class No. 64. Tallow, soap.

H. Lissberger	*85 00
J. H. Walker	92 50
S. C. Carll	95 00
E. V. White & Co	100 00
David Babcock & Co	105 00

Class No. 68. Glass:

J. H. Walker	*321 62
Arthur & Bonnell	333 75
Bellah, Quigley & Co	338 25
J. W. Gaskill & Sons	341 25
U. S. White Lead Co	349 25
E. V. White & Co	450 75
George P. Goff	577 50
S. C. Carll	590 50

Class No. 69. Brushes:

J. H. Walker	*239 75
H. Lissberger	299 75
U. S. White Lead Co	405 85
S. C. Carll	458 15
C. A. Burgess & Co	547 00

Class No. 70. Dry goods:

H. Lissberger	*234 04
J. H. Walker	250 65
Noblit, Brown, Noblit & Co	380 62
S. C. Carll	415 90

Class No. 71. Stationery:

Solomons & Chapman	*283 19
William H. Dempsey	301 51
Arthur & Bonnell	369 94

Class No. 73. Ship-chandlery:

H. Lissberger	*505 10
J. H. Walker	658 70

Class No. 77. Belting, packing:

H. Lissberger	*95 75
Stephen Ballard & Co	148 75
J. H. Walker	161 50
William A. Torrey & Co.	238 00
E. V. White & Co	276 25
S. C. Carll	400 00

Class No. 78. Leather:

Stephen Ballard & Co	*36 00
H. Lissberger & Co	40 80
J. H. Walker	41 40
E. V. White & Co.	48 00
S. C. Carll	54 00

Opened in presence of—
J. W. EASBY, *Chief of Bureau.*
H. A. GOLDSBOROUGH, *Chief Clerk.*
THOMAS J. LASIER, *Clerk.*

NAVY DEPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR,
September 25, 1877.

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*Accepted. †Class not awarded.

Offer to furnish material for the Navy under the advertisement of the Bureau of Construction and Repair of August 21, 1877, *at the navy-yard, Mare Island.*

Class No. 7. Oregon pine logs:

A. Powell	*$3,127 53
James & Abbott	5,782 98

Class No. 8. Oregon pine beams:

A. Powell	*1,314 69
James & Abbott	2,494 54

Class No. 9. Yellow-pine mast-timber:

A. Powell	*7,900 50
James & Abbott	8,014 00

Class No. 13. Sugar-pine plank and boards:

A. Powell	*4,320 00
James & Abbott	6,304 00

Class No. 16. White-ash oars:

De Grauw, Aymar & Co.	*182 52
J. H. Walker	212 94
David Babcock & Co.	324 48
A. Powell	344 76

Class No. 24. White-oak staves and heading: †

Class No. 32. Wrought iron, round and square:

J. S. Van Winkle	(‡)
James E. Gordon	*510 00
Baker & Hamilton	551 00
H. Lissberger	560 00
J. H. Walker	1,040 00

Class No. 35. Steel:

H. Lissberger	*380 25
Midvale Steel Works	418 50
J. H. Walker	469 50
J. S. Van Winkle	502 50
David Babcock & Co.	528 00

Class No. 42. Lead, pipe, sheet:

H. Lissberger	*1,656 25
J. H. Walker	2,101 25
Baker & Hamilton	2,240 00
David Babcock & Co.	2,276 25

Class No. 43. Zinc:

H. Lissberger	*560 00
J. H. Walker	730 00
David Babcock & Co.	740 00

Class No. 44. Tin:

H. Lissberger	*$470 00
J. H. Walker	607 50
David Babcock & Co.	610 00

Class No. 48. Locks, hinges, &c.:

H. Lissberger	*293 90
James E. Gordon	377 00
J. H. Walker	473 16

Class No. 49. Screws:

H. Lissberger	*163 65
James E. Gordon	192 25
J. H. Walker	199 45
Baker & Hamilton	210 30

Class No. 50. Files:

J. H. Walker	*223 83
H. Lissberger	245 68
James E. Gordon	267 05
C. H. Wight	283 80
Baker & Hamilton	307 99

Class No. 51. Augers:

H. Lissberger	*221 60
James E. Gordon	338 40
J. H. Walker	364 70

Class No. 52. Tools for ships' stores:

James E. Gordon	*194 50
H. Lissberger	276 00
Baker & Hamilton	302 84
J. H. Walker	551 35

Class No. 53. Tools for yard use:

H. Lissberger	*397 50
Baker & Hamilton	483 55
J. H. Walker	627 25

Class No. 54. Hardware:

J. H. Walker	*1,434 05
H. Lissberger	1,467 95
David Babcock & Co	1,497 41

Class No. 56. White lead:

H. Lissberger	*1,460 00
Whittier, Fuller & Co.	1,900 00
J. H. Walker	2,150 00
David Babcock & Co	2,750 00

Class No. 57. Zinc paint:

H. Lissberger	*280 00
J. H. Walker	520 00
Whittier, Fuller & Co.	520 00

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* Accepted. † Class not awarded. ‡ Informal.

Class No. 58. Colored paints:

Whittier, Fuller & Co...	*$463 10
H. Lissberger...........	640 22
J. H. Walker	666 80

Class No. 59. Linseed-oil:

H. Lissberger...........	*1,270 00
J. H. Walker	1,390 00
Whittier, Fuller & Co...	1,530 00
F. B. Taylor............	1,550 00

Class No. 60. Varnish, &c.:

Whittier, Fuller & Co...	*1,194 00
J. H. Walker	1,287 00
F. B. Taylor	1,325 00
H. Lissberger...........	1,907 50

Class No. 63. Sperm and lard oil:

H. Lissberger...........	*370 00
Whittier, Fuller & Co...	400 00
F. B. Taylor	437 50
J. H. Walker	500 00

Class No. 64. Tallow, soap:

H. Lissberger...........	*21 50
J. H. Walker	42 50
A. Powell...............	51 00

Class No. 65. Fish-oil:

Whittier, Fuller & Co...	*22 50
F. B. Taylor............	27 50
H. Lissberger...........	29 00
J. H. Walker	33 00

Class No. 68. Glass:

Whittier, Fuller & Co...	*$129 00
J. H. Walker	210 00

Class No. 69. Brushes:

H. Lissberger...........	*120 75
Whittier, Fuller & Co...	198 25
J. H. Walker	239 50

Class No. 70. Dry-goods:

H. Lissberger...........	*138 00
J. H. Walker	400 00
A. Powell	457 50

Class No. 71. Stationery:

L. H. Bonestell.........	*258 58
Wm. H. Dempsey.......	743 00

Class No. 73. Ship-chandlery:

H. Lissberger...........	*357 75
J. H. Walker	569 80

Class No. 78. Leather

H. Lissberger...........	*157 00
J. H. Walker	229 00
Horatio N. Cook	246 00
A. Powell...............	350 00

Class No. 85. Anthracite coal:

William Walker	*3,750 00
A. Powell	4,250 00
James McCudden	4,487 50

Opened in presence of—
J. W. EASBY, *Chief of Bureau.*
H. A. GOLDSBOROUGH, *Chief Clerk.*
THOMAS J. LASIER, *Clerk.*

NAVY DEPARTMENT,
BUREAU OF CONSTRUCTION AND REPAIR, *September* 25, 1877.

No. 11.—MARINE CORPS.

HEADQUARTERS MARINE CORPS,
Washington, D. C., November 16, 1877.

SIR: I have the honor to state that at the present time there are 1,971 enlisted men in the Marine Corps, of which number 1,034 are on board vessels in commission, and 937 at the several shore-stations.

REDUCTION OF OFFICERS.

In compliance with the naval appropriation bill of 1876–'77, which provides "that no appointments shall be made until the number of officers is reduced to 75," the present list has been reduced by five officers, with two more to follow soon.

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*Accepted.

REDUCTION OF ENLISTED MEN.

The naval appropriation bill of 1875-'76 provided that the appropriation "should be for 1,500 privates, and no more." This number has proved totally inadequate to the wants of the Navy, and I urgently recommend that Congress allow the estimates for 1,800 privates to pass. As this requires no other action, I trust it may be favorably considered by the department, and inclose additional estimates for 300 privates.

REFORMS.

Many needed reforms have been introduced, particularly in the more systematic instruction of officers and non-commissioned officers in tactics and other duties, in the examination of non-commissioned officers before promotion (which should also be required of the officers), and the giving of warrants to the same by the commandant.

The reduction of non-commissioned officers in the United States, by the Colonel Commandant only, is also a much valued reform, as is the present system of discharges.

CLOTHING FOR ENLISTED MEN.

The standard of materials for clothing is now in many cases that used in the Army, but what is still needed is to manufacture the clothing for enlisted men at the quartermaster's depot of the corps in Philadelphia, instead of having it made by contract. This would give us as good clothing as that of the Army.

BARRACKS.

The appropriation for repair of barracks has been so small for several years past, viz, $5,000 per annum, that but little has been done, and a larger appropriation for this year is urgently needed. Estimates are submitted. I inclose, also, estimates for building barracks and quarters at League Island, Annapolis, and Norfolk, and trust that the old hulks and sheds in which the men are quartered may give place to proper barracks.

The money annually appropriated for "hire of quarters" for officers at Norfolk, Annapolis, League Island, and Washington, D. C., would in a few years build good quarters at all these stations, so that they could live near the men, which is greatly needed.

SUTLERS.

The system of sutlers in the Marine Corps needs change, being a relic of the past, and having been abolished as such in the Army. There are no regulations to govern this matter other than the obsolete Army ones. Under no circumstances should enlisted men be sutlers, or agents for the same. It is subversive of discipline and good order, and reduces the first sergeants, who have been allowed by long custom to act in that capacity, to mere traders, selling to the men, not to speak of other abuses flowing from it.

DISCIPLINE.

The discipline and efficiency of the Corps is excellent, but both on shore and on board ship a code of regulations is much needed to define its duties. A board, composed of officers of the Navy and Marine Corps, should be ordered to prepare one. No officer of the Marine Corps was on the board which drew up the present Navy Regulations, although the Corps constituted, at that time, one-fifth of the whole Navy.

BAND.

An increase of the band of the Marine Corps is urgently recommended, as well as placing it upon a proper footing as regards classes and pay.

This band is properly a national band, being used for all official purposes in Washington.

RECENT SERVICES OF THE CORPS.

During the past summer, upon the requisitions of the governors of various States, several detachments of the Marine Corps were actively engaged in guarding public and private property from mob violence, and in every case the officers and men received the highest praise from Generals Hancock and Barry, under whom they served, as well as the merited commendation of the department.

Very respectfully, your obedient servant,

C. G. McCAWLEY,
Colonel, Commandant.

Hon. RICHARD W. THOMPSON,
Secretary of the Navy, Washington, D. C.

HEADQUARTERS MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., August 3, 1877.

SIR: During my recent visit under orders to Portsmouth, N. H., Boston, Mass., Brooklyn, N. Y., and League Island, I inspected with the commanding officer at each post the condition of the buildings and grounds, with a view to such repairs as may be necessary for the present year, and beg leave to report as follows:

At Portsmouth, the buildings and grounds are in fair condition, and the estimated cost of keeping them so during present fiscal year is $613. That which most needs attention now is the water-closets to officers quarters, and the entire drainage to barracks.

At Boston, the barracks and quarters are in reasonably good order, but certain repairs and improvements are recommended, the estimated cost of which, as presented by a board of survey, is $2,666. Of the work thus recommended I would specially notice, as of most importance, the replacing the steps leading from the navy-yard to the front of commanding officer's quarters on Chelsea street, and the remodeling and enlarging the cells above the guard-room by removing cells Nos. 6 and 7 in front of the windows facing the parade-ground, and altering cells Nos. 2, 3, 4, and 5 into two cells, thereby improving their size and ventilation, and making them proper cells for long confinement of prisoners, which at present they are not. Also the erection of a small addition to the left-wing quarters sufficient to contain two separate bath-rooms and water-closets. In view of the fact that officers with and without families occupy the same building, these conveniences should be regarded as a necessity.

The Brooklyn barracks, though presenting quite a creditable appearance viewed from the outside, were, upon a close inspection, found to need considerable repairs of a minor character, and to require painting inside and out, the estimated cost of which, by Mr. John K. Bullman, general superintendent of the department of yards and docks at the Brooklyn navy-yard, who was associated with the board of survey, is $8,147.85. This is a large sum to expend upon barracks, simply as repairs, but from some cause these barracks have fallen into a much worse condition than either the Portsmouth or Boston barracks, and, though the whole amount named may not be required to put them in the condition they should be, several thousand dollars in addition to the usual yearly apportionment will be necessary.

At League Island the officers and men are quartered aboard the United States ship St. Louis. In contemplation of the erection of barracks on the island for the more comfortable quartering of the command, the civil engineer at League Island has presented a plan, and estimates the cost of building at $7,500.

RECAPITULATION.

For repairs at Portsmouth, N. H		$613 00
For repairs at Boston, Mass		2,666 00
For repairs at Brooklyn, N. Y		8,147 85
Total for repairs		11,426 85

Estimates for the following work have been received, and are also submitted:

For construction of barracks, League Island	$7,500 00	
For construction of commanding officer's quarters, Norfolk	4,500 00	
For construction of subalterns' quarters, Norfolk	8,425 25	
For construction of commanding officer's quarters, Annapolis	6,289 00	
For construction of subalterns' quarters, Annapolis	13,988 00	
For construction of barracks, Annapolis	21,408 00	
		62,110 25
Aggregate amount		73,537 10

I am, very respectfully, your obedient servant,

W. B. SLACK,
Quartermaster Marine Corps.

Col. CHAS. G. McCAWLEY,
Commandant United States Marine Corps, Washington, D. C.

HEADQUARTERS MARINE CORPS,
Washington, D. C., September 6, 1877.

SIR: I respectfully forward to the department, in duplicate, "estimates of appropriations for the paymaster's and quartermaster's departments, United States Marine Corps," for the fiscal year ending June 30, 1879.

I also inclose letters from the paymaster and quartermaster in relation to the estimates.

I have the honor to be, your obedient servant,

C. G. McCAWLEY,
Colonel, Commandant.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington, D. C.

HEADQUARTERS MARINE CORPS,
QUARTERMASTER'S OFFICE,
Washington, D. C., September 5, 1877.

SIR: I respectfully submit herewith estimates of appropriations required for the service of the fiscal year ending June 30, 1879, by the quartermaster's department of the Marine Corps.

These estimates vary from those submitted for fiscal year ending June 30, 1878, as follows:

Provisions, decreased	$14,126 50
Clothing, decreased	10,268 00
Fuel, decreased	1,950 00
Military stores, increased	1,000 00
Repair of barracks, decreased	4,000 00

The aggregate amount of these estimates is $29,026.50 less than that asked in estimates of last year.

As directed by you, I submit estimates of appropriations required by the quartermaster's department for the support of an increase of three hundred privates, amounting to $40,093. I also inclose schedule, in duplicate, of proposals received by the quartermaster's department for the supply of rations and fuel to the Marine Corps during fiscal year ending June 30, 1878.

I am, very respectfully, your obedient servant,

W. B. SLACK,
Quartermaster Marine Corps.

Col. CHAS. G. McCAWLEY,
Commandant United States Marine Corps, Headquarters.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, *by the Quartermaster's Department, United States Marine Corps.*

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1878.
PROVISIONS.			
1,000 non-commissioned officers, musicians, privates, and washerwomen, 365 days, at one ration per day, is 365,000 rations, at 22 cents	$80,300 00		
Difference between the cost of rations at 22 cents and commutation at 75 cents, for ten enlisted men, employed as clerks, messengers, laborers, &c., in commandant's, adjutant's and inspector's, quartermaster's and assistant quartermaster's offices for 365 days, being 3,650 rations, at 53 cents	1,934 50	$82,234 50	$88,300 00
CLOTHING.			
2,000 non-commissioned officers, musicians, and privates, at $33.26 per annum, actual cost per contract 1876–'77	66,250 00		
400 overcoats, at $8.40 each	3,360 00	69,610 00	40,000 00
FUEL.			
3,894 cords of wood, as follows: one colonel commandant, one colonel, two lieutenant-colonels, four majors, three staff-majors, two staff-captains, twelve captains, fifteen first lieutenants, fifteen second lieutenants, one thousand non-commissioned officers, musicians, privates, and washerwomen; six hospitals, one armory, five mess-rooms for officers, sixteen offices for commandant and staff and commanding officers of ports, nine rooms for officers of the day, nine guard-rooms at barracks and navy-yards, three stores for clothing and other supplies; one-fourth additional on 2,400 cords, quantity supposed to required in latitude north 36 degrees from September 1 to April 30, 600 cords, amounting in all to 3,892 cords, which, at $6.50 per cord, is	....	25,311 00	25,000 00

Estimates of appropriations required for the fiscal year, &c.—Continued.

Detailed objects of expenditure, and explanations.	Estimated amount which will be required for each detailed object of expenditure.	Total amount to be appropriated under each head of appropriation.	Amount appropriated for the current fiscal year ending June 30, 1878.
MILITARY STORES.			
Pay of mechanics employed in armorer's shop, Washington, repair of arms, purchase of military equipments, ordnance stores, flags, drums, fifes, and other instruments for the band		$10,000 00	$5,000 00
TRANSPORTATION AND RECRUITING.			
Transportation of troops and expenses of recruiting		8,000 00	5,000 00
REPAIR OF BARRACKS.			
Portsmouth, N. H., Boston, Mass., Brooklyn, N. Y., Annapolis, Md., Headquarters, Washington, D. C., Navy-yard, Washington, D. C., Gosport, Va., Mare Island, Cal., and for rent of offices where there are no public buildings		11,000 00	5,000 00
HIRE OF QUARTERS.			
Hire of quarters for officers where there are no public buildings		16,000 00	16,000 00
FORAGE.			
Forage for public horses and the authorized number of officers' horses		5,000 00	5,000 00
CONTINGENCIES.			
For freight, ferriage, toll, cartage, per diem for constant labor, funeral expenses of marines, stationery, telegraphing, apprehension of deserters, oil, gas, candles, repair of gas and water-fixtures, water-rent, barrack furniture, furniture for government houses and offices, packing-boxes, bed-sacks, wrapping-paper, oil-cloth, crash, rope, twine, carpenters' tools, tools for police purposes, purchase of fire-extinguishers, purchase and repair of hose, repairs to public carryall, purchase and repair of harness, purchase and repair of hand-carts and wheelbarrows, purchase and repair of cooking-stoves, ranges, &c., stoves where there are no grates, gravel, &c., for parade-ground, repair of pumps, and for other purposes		25,000 00	20,000 00
PRINTING.			
For printing and binding, to be executed under the direction of the Government Printer		5,000 00	
Total		257,155 50	209,300 00

Submitted September 5, 1877.

HEADQUARTERS MARINE CORPS, QUARTERMASTER'S OFFICE.

W. B. SLACK,
Quartermaster, Marine Corps.

Forwarded:
C. G. MCCAWLEY,
Colonel, Commandant.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, *by the quartermaster's department, Marine Corps.*

Detailed objects of expenditure, and explanations.	Total amount to be appropriated under each head of appropriation.
PROVISIONS.	
300 privates, 365 days, at one ration per day each, is 109,500 rations, at 22 cents per ration (submitted)	$24,090 00
CLOTHING.	
300 privates, at $33.26 each per annum, actual cost per contracts 1876–'77 (submitted)	9,978 00
FUEL.	
300 privates, at one and a half cords each, 450 cords, at $6.50 per cord (submitted)	2,925 00
MILITARY STORES.	
Military equipments for 300 privates (submitted)	1,600 00
TRANSPORTATION AND RECRUITING.	
Transportation and expenses of recruiting 300 privates (submitted)	1,500 00
Total	40,093 00

Respectfully submitted.

W. B. SLACK,
Quartermaster Marine Corps.

QUARTERMASTER'S OFFICE,
UNITED STATES MARINE CORPS,
Washington, D.C., September 5, 1877.

Forwarded:
C. G. McCAWLEY, *Colonel, Commandant.*

ABSTRACT OF PROPOSALS RECEIVED FOR FURNISHING FUEL AND RATIONS TO THE UNITED STATES MARINE CORPS, UNDER THE COGNIZANCE OF THE QUARTERMASTER'S DEPARTMENT.

Proposals for rations under advertisement May 1 *and July* 18, 1877.

Stations.	Bidders.	Rations, per hundred.
Portsmouth, N. H.	Peters Bros	$23 00
	James E. Chase	24 45
	N. F. Mathes	*18 49
	Harry W. Hall	18 90
	Peter Higgins	19 69¼
	Kimberly Bros	23 40
Charlestown, Mass.	Peters Bros	23 00
	N. F. Mathes	25 00
	Harry W. Hall	*19 45
	John C. Gilbert	24 00
	Kimberly Bros	21 00
Brooklyn, N. Y.	Peters Bros	21 60
	N. F. Mathes	24 00
	Harry W. Hall	*18 20
	John C. Gilbert	18 22
	Kimberly Bros	18 25
Philadelphia, Pa.	Peters Bros	23 00
	N. F. Mathes	28 50
	John C. Gilbert	29 00
	Kimberly Bros	23 49
Washington, D. C.	Peters Bros	21 60
	N. F. Mathes	23 50
	Harry W. Hall	*16 90
	John C. Gilbert	18 00
	Kimberly Bros	18 15
Gosport, Va.	Peters Bros	20 90
	N. F. Mathes	25 00

* Accepted.

Proposals for rations under advertisement May 1 and July 18, 1877.

Stations.	Bidders.	Rations, per hundred.
Gosport, Va	Harry W. Hall	$18 20
	John C. Gilbert	29 00
	Kimberly Bros	*18 05
Annapolis, Md	John Kealy	19 00
	N. F. Mathes	25 00
	Harry W. Hall	19 00
	John C. Gilbert	29 00
	Kimberly Bros	*18 24
Mare Island, Cal	J. A. McInnis	25 99
	Hanley & Snow	27 00
	N. F. Mathes	22 99
	Harry W. Hall	*22 90
	John C. Gilbert	30 00
	Kimberly Bros	29 00
League Island, Pa	N. F. Mathes	23 00
	H. W. Hall	*18 90
	Samuel T. Reckless	24 00

*Accepted.

Proposals for fuel under advertisement May 3, 1877.

Stations.	Bidders.	Wood, per cord.	Coal, per ton.
Portsmouth, N. H	William H. Sise	....	$5 15
	Peters Bros	$13 50	7 90
	Hamilton A. Mathers	*6 12	....
	C. E. Walker & Co	....	*5 00
	G. A. Hammond	7 75	....
	N. F. Mathes	6 50	....
Charlestown, Mass	Samuel Knight	8 00	5 00
	Peters Bros	12 30	7 40
	C. A. Campbell	*7 00	*4 70
Brooklyn, N. Y	Peters Bros	11 50	5 87
	A. F. Nathan	....	5 00
	Samuel G. French	*9 35	*3 94
Philadelphia, Pa	James J. Convery	*7 45	....
Washington, D. C	Peters Bros	8 30	5 87
	Johnson Bros	4 40	4 05
	John McElroy	5 43	4 42
	L. W. Guinand	....	*3 79
	Norman L. Fowler	4 47	4 39
	G. Y. At Lee	*4 25	4 15
	A. A. McCullough	6 80	4 40
Gosport, Va	Peters Bros	*4 27	*4 37
	John W. Oast	4 75	....
	Norman L. Fowler	6 50	....
	A. A. McCullough	4 80	4 40
	John Kealy	....	7 00
Annapolis, Md	George C. Cross	5 94	....
	Johnson Bros	*5 85	....
Mare Island, Cal	Arthur M. Ebbetts	....	19 90
	J. A. McInnis	*10 75	*19 75
	James McCudden	11 10	21 00
	N. F. Mathes	11 47½	....

*Accepted.

HEADQUARTERS MARINE CORPS,
Quartermaster's Office, Washington, September 5, 1877.

W. B. SLACK, *Quartermaster Marine Corps.*

Forwarded:
C. G. MCCAWLEY, *Colonel Commandant.*

HEADQUARTERS MARINE CORPS,
Paymaster's Office, August 9, 1877.

SIR: I respectfully submit herewith estimates in detail for the pay of officers, non-commissioned officers, musicians, privates, and others of the United States Marine Corps, for the fiscal year ending June 30, 1879.

I am, very respectfully, yours, &c.,
GREEN CLAY GOODLOE,
Major and Paymaster Marine Corps.

Col. CHAS. G. MCCAWLEY,
Commandant United States Marine Corps, Headquarters.

Estimates of appropriations required for the service of the fiscal year ending June 30, 1879, *by the paymaster of the United States Marine Corps.*

Detailed objects of expenditure, and explantions.		Estimated amount which will be required for each detailed object of expenditure.	Amount appropriated for the current fiscal year ending June 30, 1878.
PAY OF OFFICERS, NON-COMMISSIONED OFFICERS, MUSICIANS, PRIVATES, AND OTHERS OF THE UNITED STATES MARINE CORPS; FOR TRANSPORTATION OF OFFICERS TRAVELING WITHOUT TROOPS, AND FOR PAYMENTS TO DISCHARGED SOLDIERS FOR CLOTHING UNDRAWN.			
1 colonel commandant	Rev. Stat. p. 271, sec. 1596; sec. 1623; acts of June 30, 1834 (4 Stat. at L., p. 713, secs. 4, 5), March 2, 1847 (9 Stat. at L., p. 155, sec. 3), August 5, 1854 (10 Stat. at L., p. 506, sec. 1), February 21, 1857 (11 Stat. at L., p. 163, sec. 1), July 17, 1862 (12 Stat. at L., p. 594, sec. 2), June 30, 1864 (13 Stat. at L., p. 144, sec. 1), March 3, 1865 (13 Stat. at L., p. 487, sec. 1), July 28, 1866 (14 Stat. at L., p. 334, sec. 13), July 28, 1866 (14 Stat. at L., p. 337, sec. 37), March 2, 1867 (14 Stat. at L., p. 422, sec. 1), July 15, 1870 (14 Stat. at L., p. 317, sec. 7), January 18, 1875 (18 Stat. at L., p. 301, sec. 1); Navy Regulations; and act of July 18, 1876.	$4,500	
1 colonel		4,500	
2 lieutenant-colonels		8,000	
1 adjutant and inspector, 1 quartermaster, and 1 paymaster		10,000	
4 majors		14,000	
2 assistant quartermasters		5,400	
20 captains		46,800	
30 first lieutenants		54,750	
21 second lieutenants		29,540	
1 brigadier-general, retired-list		4,125	
1 lieutenant-colonel, retired-list		3,000	
3 majors, retired-list		7,500	
1 assistant quartermaster, retired-list		2,100	
3 captains, retired-list		4,455	
1 first lieutenant, retired-list		1,125	
2 second lieutenants, retired-list		2,100	
1 leader of the band		948	
1 sergeant-major, 1 quartermaster-sergeant, and 1 drum-major		1,080	
50 first sergeants		16,200	
140 sergeants		31,560	
180 corporals		35,400	
30 musicians		9,996	
96 drummers and fifers		17,736	
1,500 privates		270,000	
10 clerks and 2 messengers		10,000	
Payments to discharged soldiers for clothing undrawn		20,000	
Transportation of officers traveling without troops		5,000	
		619,815	$619,825

GREEN CLAY GOODLOE,
Major and Paymaster Marine Corps.

HEADQUARTERS MARINE CORPS,
Paymaster's Office, August 9, 1877.

Forwarded:
C. G. MCCAWLEY,
Colonel Commandant.

No. 12.—REPORT OF THE SUPERINTENDENT ON THE REMOVAL OF THE NAVAL OBSERVATORY.

UNITED STATES NAVAL OBSERVATORY,
Washington, September 15, 1877.

SIR: I found, upon taking charge of the Observatory, that the malarious influences surrounding it were notorious, and that from May to about the middle of October the officers whose services were necessarily in the Observatory at night, paid the penalty in impaired health and in diminished efficiency. The fogs which arise from the river, driven by the prevailing winds, float above the instruments and lessen their usefulness.

Withal, the board of survey created by act of Congress in 1872, stating in their report that the site of the Observatory is needed for projected improvements, recommend that the observatory be removed from its present locality to a better one. They remark, with apparent truth, that the sale of this reservation (No. 4) "would produce a sum sufficient to procure a site abundantly large, where this great Institution in which all Americans take just pride, could be developed on a scale which its merits and importance demand."

For these reasons, I earnestly recommend that a suitable site, north of the city and inside the District of Columbia, be procured for a new Observatory.

The area allotted to this purpose need not necessarily be more than twenty-five or thirty acres in extent; but as much as this is needed, since, if surrounded by dwellings or factories, the smoke would obscure the clearness of vision, the traffic would shake the instruments, and some high structure, if placed upon the meridian near our instruments, might hide a useful part of the heavens.

The present Observatory is in a very dilapidated condition, and it will require $28,909.35 to put it in suitable repair. An inspection of the premises will show better than words how imperative it is to make provision for its renovation.

The expense attending this may be avoided, however, in case Congress shall agree to remove the Observatory to a less objectionable place.

As preliminary to any change of site, the land must be procured, and before the Observatory can be built plans and specifications must be prepared for the work, I have asked for $100,000, or so much thereof as may be necessary, to effect these objects.

I append hereto copies of some papers bearing upon the expediency of removing the Observatory.

I have the honor to be, very respectfully, your obedient servant,

JOHN RODGERS,
Rear-Admiral, Superintendent.

Hon. R. W. THOMPSON,
Secretary of the Navy, Washington.

No. 1617 H STREET, WASHINGTON,
September 4, 1877.

SIR: In answer to your communication of the 3d instant, requesting my opinion as to the sanitary condition of the Naval Observatory, I beg to state that I had medical charge of the naval officers and their families at Washington, including the observatory, for two terms, together embracing a period of nearly eight years, viz, from February 1, 1851, to January 11, 1855, and from December 31, 1864, to January 15, 1869.

From this experience, I am decidedly of the opinion that the location of the observatory is unhealthful, caused, as I think, by the malaria from the shores of the Potomac, from which no artificial means will secure it.

In this connection I forward to you a copy of the certificate of death which I made to the Medical Bureau in the case of Capt. James M. Gilliss, United States Navy, Superintendent, who died at the Observatory on the 9th of February, 1865.

I do not doubt that a healthful site for the Observatory may be found on the high grounds to the north of Washington.

I am, very respectfully, your obedient servant,

GEORGE CLYMER,
Medical Director, United States Navy.

Rear-Admiral JOHN RODGERS,
Naval Observatory, Washington, D. C.

Copy of the "certificate of death" made to the Medical Bureau; accompanying letter reporting the death of Captain Gilliss.

I hereby certify that James M. Gilliss, who was a captain in the United States Navy, while attached to the Naval Observatory, and holding the rank above mentioned, departed this life on the 9th day of February, in the year 1865; and that he died of serous apoplexy, as set forth in the record of his case, as follows:

Captain Gilliss had been stationed at the Naval Observatory for some years, a locality noted for its insalubrity. During the last summer and fall he was frequently attacked with intermittent and, on one occasion, with remittent fever, which left him in a weak condition; this, combined with excessive mental labor incident to his position, no doubt caused his death in the line of duty.

GEORGE CLYMER,
Surgeon, United States Navy.

WASHINGTON, D. C., *September* 7, 1877.

SIR: In reply to your letter of the 3d instant, asking my opinion with regard to the sanitary character of the Naval Observatory, I have to state that during my two terms of service there, March 1, 1856, to 22d April, 1859, and from 27th February, 1869, to April 1, 1873, frequent cases of malarial fever occurred among the officers, more especially those engaged in night observations.

The families of the superintendents residing at the Observatory suffered most severely, the effects of which can even yet be observed in some cases.

The ground on which the buildings stand has a subtratum of red sand, porous, and consequently unhealthy. The miasmata from the adjacent marshes, wafted by the prevailing southwest and southeast winds, penetrate every crevice, and the dense fogs from the shores of the Potomac so envelop the entire hill as to render at times observation impossible. I, therefore, consider the observatory, with its surroundings, eminently unhealthy and unsuited for the purposes intended; and that its removal to some more eligible height, westward of the city, not only desirable but necessary; and would further add, that its removal would enable the city authorities to carry out certain contemplated improvements by which the cause of disease in the vicinity would be, in a great measure, removed, and an enhanced value given to property having now a merely nominal one.

With respect,

CHAS. D. MAXWELL,
Medical Director, United States Navy.

Rear-Admiral JOHN RODGERS,
Superintendent Naval Observatory.

UNITED STATES NAVAL DISPENSARY,
Washington, D. C., September 10, 1877.

SIR: In compliance with your request, contained in a communication dated September 3, instant, asking my professional opinion of the sanitary condition of the location of the United States Naval Observatory, I beg leave to state that during the two years I have been attached to the Naval Dispensary, as attending surgeon, the officers of the observatory have been frequently sick from the effects of constant exposure to malarial influences in the discharge of their official duties.

I do not think that any very material improvement can be made in the buildings or grounds that will effectually eliminate the local causes of disease, even by the expenditure of large sums of money. It seems to me that it would be true economy to remove the entire establishment to some desirable point in the vicinity of Washington, where the necessary sanitary conditions might be fully secured to maintain the personnel of the observatory in the highest state of physical efficiency.

Very respectfully, your obedient servant,

PHILIP S. WALES,
Medical Inspector, United States Navy.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent United States Naval Observatory.

GEORGETOWN, D. C., *September* 5, 1877.

DEAR SIR: In reply to your request, I will state that thirty years, or more, I have, from personal observation, been familiar with the state of health at the present location of the Naval Observatory.

During this whole period it has been subject to malarial fever. I have attended numbers in that locality, and I do not think that any summer or autumn has passed without its development.

Very respectfully,

GRAFTON TYLER, M. D.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent, &c.

WASHINGTON, *September* 7, 1877.

DEAR SIR: In reply to your letter of the 6th instant, I would respectfully state that from over twenty years' experience of practice in the immediate neighborhood of the United States Observatory, I have been convinced of the unhealthfulness of that part of the city, owing to the condition of the river shores and flats.

During both periods of Admiral Davis's command at the Observatory

I was frequently called to attend different members of his family who were suffering from some form of malarial fever, notwithstanding the Admiral took the precaution to send all his household away during the summer and fall months.

Although the Admiral's death was not directly due to malarial fever, yet I am convinced that his residence at the Observatory was one of the principal causes of undermining his health and thus tended to shorten his life.

Very respectfully, your obedient servant,

D. R. HAGNER, M. D.,
1812 *H Street.*

WASHINGTON, D. C., *September* 3, 1877.

MY DEAR SIR: I have had the honor to receive your favor of the 1st instant, requesting me to state if, in my opinion, the disease of which the late Professor Ferguson died was due to malarial agencies which affect the sanitary condition of the Naval Observatory.

In reply, I do not hesitate to say that for a long period, running through many years antecedent to his death, Professor Ferguson was subject to slight attacks of malarial fever, the origin of which I traced directly to his residence at the Observatory.

It is a fact easily authenticated by the observation and experience of the older practitioners of medicine in this city (especially I would refer to Dr. J. C. Hall), that malarial fevers of a severe type have prevailed in that locality since the erection of the Observatory, the families of those naval officers who were required to reside there being compelled to abandon the place during certain months of the year in consequence of its insalubrity.

During the years of 1849 and 1850, I was assigned to the duty of attending the officers stationed at this post, and had ample opportunity to observe the pernicious effects of the malaria which infested that locality. When we consider the immediate proximity of the low marshes stretching along the river at the base of the hill upon which the Observatory is situated, together with the recognized fact that marsh malaria most usually manifests its effects at the nearest eminence from its paludal source and to the leeward of the prevailing wind, we can readily understand why this locality has always been, and will continue to be, subject to malarial fevers. The truth of this statement you can at once verify by obtaining the experience of those officers who have resided at the Observatory during the last quarter of a century.

Very respectfully, your obedient servant,

ALEXR. Y. P. GARNETT, M. D.

Professor YARNALL,
Naval Observatory.

UNITED STATES NAVAL OBSERVATORY,
Washington, September 4, 1877.

SIR: I have received your letter of this instant, asking me to state my opinion, formed from the exercise of my professional duties, in regard to the condition of the atmosphere as affecting the observations which I have been called upon to make.

In answer to your communication, I would state that generally the condition of the atmosphere is favorable to observation, except in the fall, principally in September and October, we have often to stop work from the fogs which rise from the river after midnight. The banks which you may have observed from a higher position hanging over this part of the city do not, I think, much affect us.

Very respectfully, your obedient servant,

M. YARNALL,
Professor Mathematics, United States Navy.

Rear-Admiral JOHN RODGERS,
Superintendent of the Observatory.

UNITED STATES NAVAL OBSERVATORY,
Washington, September 5, 1877.

SIR: You have requested me to give you an idea of my impressions with regard to malaria at the Observatory from my long experience of twenty-five years' service connected with it.

When I joined the force at the observatory, it being the 2d of October, they were getting over their summer experience, and the impression then was that Commodore Morris would give an order that observations should be suspended during the last summer and first fall months. This order was not given, and we continued in the future to observe during those months.

I cannot give a better idea of the condition of our summer and fall atmosphere than to narrate its effects upon the observers and those who live at or near the observatory.

Captain Maury's family were more or less sick with chills and fever every summer.

Captain Gilliss was in the habit of using quinine very freely, and it is possible that this had something to do with his early death.

Admiral Sands generally removed his family to the country; but by remaining here a little late one summer, he was reduced to the edge of the grave.

The late Rear-Admiral Davis suffered from malaria one fall for two or three months, besides being sick with it at other times; and Mrs. Davis was made quite ill from the same cause.

The most remarkable case, however, was that of the Rev. Moses Springer, one of our aids. He was lame, and obtained board a little east of the Observatory on account of its nearness. I asked him whether he was not afraid to live so close to the Observatory; but being naturally a very robust man, he made light of it. In the summer he was attacked with bilious fever, and only recovered through the skill of the late Dr. Smoot. Upon his return to duty, I told him it was absolutely necessary for him to change his lodgings, but with fatal obstinacy he continued still to board in the same place, and the next summer was attacked with dysentery, from which, after a few months' illness, he died; a man who, I think, under favorable circumstances, would have lived to an advanced age.

The next case was that of the late Professor Hubbard, who persisted in sleeping at the Observatory; was attacked with the typhoid fever, and perished a martyr to malaria. This was a severe loss, for Hubbard was one of the brightest men we have ever had at the Observatory, and his death was deplored by the whole scientific world.

Another case of death from the same cause was that of the late James Ferguson, who as a hard worker has not had his equal. Mr. Ferguson's disease was of the kidneys, which was greatly aggravated by his constant labors in the Observatory. No thought of himself could keep him from his work, and in my opinion he perished much sooner than a man of his strong constitution should have done.

These were causes leading to death, but we have had much sickness among our watchmen, one of whom came near dying with typhoid fever caused by malaria, and others have almost always, as the fall comes around, suffered with chills and fever.

As regards myself, I have had attacks of chills and fever on several occasions, at times when I was called upon to observe the moon after midnight. Even Professor Hall, as strong as he now is, had a long spell in acquiring his acclimation.

We have all grown wiser with time, and we now cease to sleep at the Observatory. This is done at the expense of our efficiency; for it is obvious that an observer should sleep near the Observatory, so that he can be called at any time of night.

Very respectfully, your obedient servant,

M. YARNALL,
Professor of Mathematics.

Rear Admiral JOHN RODGERS, U. S. N.,
Superintendent United States Naval Observatory.

UNITED STATES NAVAL OBSERVATORY,
Washington, D. C., September 10, 1877.

SIR: In answer to yours of the 4th instant, I would respectfully state that I entirely concur with your view that the Observatory should be removed to a better location, for the following reasons:

1. The unhealthfulness of the present location is such as greatly to diminish the working capacity of the observers. I believe that this capacity would be increased by one-third, could the observers safely live and sleep near the seat of their labors.

2. The scheme of city improvements contemplates making the region around the Observatory one of great commercial activity, and contemplates the building of a railroad around the foot of the hill on which the buildings are situated. The execution of this project would be incompatible with the continued efficiency of astronomical work in the present location.

3. The present building is entirely inadequate to the needs of a national scientific establishment, having been built more than thirty years ago, when American astronomy was in its infancy. The large and valuable library of the Observatory is outgrowing the limits which can be provided for its accommodation, and is now housed in what was formerly an observing-room, where its proper protection from the vicissitudes of weather is hardly possible. There is no proper place to store the records of observations and calculations made during the period now including thirty-two years; and the instruments used in the observations of the late transit of Venus have mostly to be stored in a small room, where they are greatly exposed to destruction by fire. The architecture of the present building is such that it cannot be readily enlarged to meet the increasing needs of the establishment. One of the principal instruments of the Observatory (the prime vertical transit) has to remain unused because the room in which it is placed is appropriated as a storeroom and passage-way combined.

How inadequately the present establishment represents the science of the nation may be seen by reflecting that the great Russian observatory at Pulkowa cost $440,000, and that the Austrian Government is now erecting a new observatory on nearly as large a scale. I conceive that recent improvements in the art of observatory-construction would enable us to build an establishment as efficient as either of these at a much smaller cost.

Very respectfully, your obedient servant,

SIMON NEWCOMB,
Professor, United States Navy.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent of the Naval Observatory, Washington, D. C.

UNITED STATES NAVAL OBSERVATORY,
Washington, September 8, 1877.

SIR: In reply to your letter of the 4th instant, asking for a statement of my judgment of the condition of the atmosphere in regard to astronomical observations in the present location of the Naval Observatory, I have the honor to submit the following:

My experience is that the observations which are chiefly affected by the river fogs are those of faint objects, like comets or the small planets, when observed at a low altitude. During the summer and fall it not unfrequently happens that observations of such objects are prevented by these fogs.

I am, respectfully, &c.,

ASAPH HALL,
Professor Mathematics, United States Navy.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent Naval Observatory.

UNITED STATES NAVAL OBSERVATORY,
Washington, September 8, 1877.

SIR: I have the honor to submit the following statement, in reply to your letter of the 4th instant, asking my opinion, formed from the exercise of my professional duties, with regard to the atmospheric conditions affecting astronomical observations made at this Observatory.

My own experience, taken in connection with a study of the meteorological records of the United States, leads me to believe that the amount of clear weather in the vicinity of Washington is as great, and the atmospheric conditions are probably as favorable, to astronomical work as in any other part of the country.

Occasionally, on an otherwise clear night, a slight mist rises from the river; but it is rarely so dense as to interfere appreciably with meridian work, although perhaps it may sometimes prove an impediment in the case of very faint objects. It should be remarked, however, that these mists are confined to the river valley, and if the observatory had been situated upon the hills to the north of the city, its atmospheric conditions might, perhaps, have been slightly better than they now are.

I am, sir, very respectfully,

WM. HARKNESS,
Professor of Mathematics, United States Navy.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent United States Naval Observatory,
Washington, D. C.

UNITED STATES NAVAL OBSERVATORY,
Washington, August 31, 1877.

SIR: In regard to the location of this Observatory, I have the honor to report:

1. That the peculiar location, in addition to its effect on the health of the officers on astronomical duty, has a very bad influence on the work with the more delicate instruments. At intervals throughout the year, and on nearly *every* night from May to December, the surface of the Potomac River in the vicinity of the Observatory is covered toward the latter part of the night with a mass of vapor or fog, which rises to such a height as completely to envelope the observatory, and is so dense as seriously to interfere with all observations of small objects.

From Georgetown Heights, the whole southwestern portion of the city is shut out of view, and the Potomac basin seems like a lake.

2. The heated air over the dwellings north of the Observatory seriously interferes, in the winter, with the definition of all objects within 25° of the horizon, and the increase of the number of buildings in that section of the city augments the difficulty every year.

Very respectfully,

JOHN R. EASTMAN,
Professor of Mathematics, United States Navy.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent United States Naval Observatory.

PHILADELPHIA, *September* 8, 1877.

ADMIRAL: During a service of nearly five years at the Naval Observatory, I have been engaged on the transit-circle and the 26-inch equatorial, and frequently the subject of observation has been situated low down toward the southern horizon. I have also observed the same object at other observatories, principally at West Point, N. Y., at Dr. Draper's private observatory, at Hastings, on the Hudson, and at the observatory of Harvard College. My invariable experience has been that the atmospheric conditions obtaining at Washington for objects of low altitude are less favorable than those of the other Observatories in question, and this I attribute almost entirely to the proximity of the Naval Observatory to the river, whose fogs and vapors exert a decidedly hurtful influence upon the astronomical work. Their deleterious effects upon the health of the observers is well known, and cannot fail to affect in its way the activity and usefulness of the institution.

At the above-named Observatories upon the Hudson, I have frequently had an opportunity to see the fog lying in and just above the river, and generally in the lower places, while the Observatory itself was in these cases free from fog.

At Washington I have often observed a similar effect, with the difference that the situation of the Naval Observatory exposes it to the effect of the fogs which are escaped by the others. It is the result of my experience that the situation of the Naval Observatory is unfavorable in this regard for the prosecution of observations near the horizon, and this is particularly the case with the important work of the transit-circle and the 26-inch equatorial.

I have the honor to be, Admiral, very respectfully, your obedient servant,

EDWARD S. HOLDEN,
Professor, United States Navy.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent United States Naval Observatory.

Extract from the "Report of the Board of Survey, ordered by Congress, on the improvement of the Harbor of Washington and Georgetown, District of Columbia, 1872."

* * * * * * *

Reservation No. 4, at the southwest edge of the city, on the Potomac, together with a small amount of private property adjoining, is located on a high hill, requiring very steep grades in the adjacent streets. Along the foot of this hill runs the water-front, in such close proximity as to render it totally unavailable for any business purpose. The necessities of the improvements in this part of the city demand the reduction of this hill and high ground to such grades as the authorities of the District may deem necessary to meet the emergencies of the case.

Unfortunately, upon this reservation is situated one of the very best, most ably conducted, and valuable scientific institutions of the government, viz, the Naval Observatory. Although it is most important that this hill be reduced, it should not and must not be at the expense of the slightest injury to this important observatory, but, on the contrary, to its great advantage. Very much better localities can be found within the District, and the sale of the reservation would produce a sum sufficient to procure a site abundantly large, where this great institution, in which all Americans take just pride, could be developed on a scale which its merits and importance demand.

We are authorized by the Secretary of the Navy to state that the department would not object to the removal of the Naval Observatory from its present to a more eligible site within the District.

The materials from this hill can be most profitably used for filling the low grounds between it and Seventeenth street west, as well as the reclaimed lands.

* * * * * * *

A. A. HUMPHREYS,
Brt. Maj. Gen. and Brig. Gen., Chief of Engineers, U. S. A.,
President.
BENJAMIN PEIRCE,
Superintendent Coast Survey.
O. E. BABCOCK,
Bvt. Brig. Gen. and Major of Engineers, U. S. A.,
Commissioner of Public Buildings and Grounds.
HENRY D. COOKE,
Governor of the District of Columbia.
ALEXANDER R. SHEPHERD,
Vice-President Board of Public Works, D. C.
C. P. PATTERSON,
Hydrographic Inspector Coast-Survey,
Secretary.

Letter from Quartermaster-General M. C. Meigs, U. S. A., to the sanitary committee of the board of health of the District of Columbia.

WASHINGTON, D. C., *August* 16, 1877.

I have not carefully studied this subject, but, from what I have observed during my residence in Washington, I am of opinion that the flats which lie above and below the Long Bridge should be diked and filled up; at first dredging a good navigable channel along the water-front, and using the earth excavated from this channel to raise the margin of the flat, while, at the same time, by a temporary railroad-track, the high ground of Camp Hill, about the Observatory, should be spread over the surface, covering the mud of the flats and that excavated from the Washington channel.

The United States Naval Observatory should be removed to the high grounds north of the city, and thus be lifted above the fogs and malaria which now interfere with astronomical observations by obstructing vision and shattering the nerves of the observers.

This improvement would increase the area of the city and improve its health. It would be a paying improvement, whether the land redeemed was laid out and sold for building purposes or planted and used as a park.

The whole fronts of the reclaimed lands should be supported by a line of revestment of stone, resting on a platform supported on piles.

I am, very respectfully, your obedient servant,

M. C. MEIGS.

WORK OF THE OBSERVATORY AND ITS APPRECIATION ABROAD.

I beg leave also to present in this connection some important considerations in relation to the work of the Observatory and the estimate placed upon it by high authorities in Europe, and I commend these statements to the attention of the department and of Congress.

The work of this observatory, like that of the Greenwich Observatory, England, has always contemplated the direct relation between the highest astronomical results and the improvement of navigation. In England, the Astronomer Royal is directed by his warrant of office "to apply himself with the most exact care and diligence to the rectifying of the tables of the motions of the heavens and the places of the fixed stars, in order to find out the so much desired longitude at sea for perfecting the art of navigation;" and the present Astronomer Royal, Sir George B. Airy, has repeatedly referred to this in his official reports, adding that "the building was erected mainly for observations of the moon and of stars regarded as accessories to lunar observations, the search for comets, &c., forming no part of the usual business of the observatory."

The United States Naval Observatory owes a like origin entirely to those wants and uses of the Navy and merchant marine that pertain to navigation, as plainly appears on reference to the recommendations of the Navy Department, the memorials presented to Congress, and the reports of its committees adopted at its establishment in 1843.

Its legitimate work in the furtherance of navigation has been steadily pursued, evidence of which is to be found in its series of annual volumes and special treatises dating from its establishment, nearly one thousand copies of which are now yearly supplied to a foreign and home demand. The larger part of its work is in fields of immediate practical value.

1. In the determination of positions of important points within our country, it is in nearly constant co-operation with the Coast Survey and with the heads of exploring parties in determining the latitudes and longitudes of cities, boundary-points, and important stations in every part of the States and Territories. Some of these determinations will be found reported in full within its volumes, as the report on the difference of longitude between Washington and Havana, and between Washington and Saint Louis, by Professor Harkness; and that on the

longitude between Washington and Detroit, Mich., and Carlin and Austin, Nev., and between Washington and Odgen, Utah, by Professor Eastman.

All longitudes in this country are now, in the first place, determined by means of or are referred to this Observatory.

2. It co-operates with the Navy in determining positions abroad. It is the depot where the chronometers for the Navy are kept and rated, and from which naval vessels are supplied with them on being placed in commission. Its appliances are always open to officers of the Army and Navy who wish to avail themselves of them in determining positions.

It drops a time-ball at noon from its own dome, and, through the agency of the telegraph wires, a ball at noon also in the city of New York; and gives the time to the wires for transmission through the United States.

3. The institution has from its foundation rendered essential aid to the American Ephemeris and Nautical Almanac by perfecting the tables indispensable to the navigator and the astronomer. Observations of the moon afford the best means for determining the longitude at sea when chronometers fail from any cause, and on land at great distances from a telegraph station. All the tables of the moon being hitherto defective, a study of the causes of these defects has been carried on for some years, founded on a discussion of all accurate observations of eclipses on record from the earliest ages to the middle of the last century.

The appreciation of the work of the Observatory by the astronomical and other scientific authorities of Europe may be learned in part by such references as follow; the only two authorities quoted being the German Astronomical Review, and the Monthly Notices of the Royal Astronomical Society of England.

I.—*Tabular exhibit of the number of pages of the International Astronomical Society's Quarterly Review (Vierteljahrschrift der Astronomischen Gesellschaft), devoted to reviewing the work of various observatories and of the astrrnomers connected with them.*

Observatory.	Astronomer.	Number of pages.	Observatory.	Astronomer.	Number of pages.
Pulkova	Struve	24.5	Berlin		12
	Döllen	6		Auwers	34
	Zinger	18		Bremiker	8.5
	Lindemann	8		Förster	2
	Gyldén	49.5			
	Fuss	8.5	Sum		56.5
	Kortazzi	3			
			Melbourne	Ellery	36
Sum		117.5		Robinson and Grubb	20
United States Naval Observatory.		42.5	Sum		56
	Newcomb	59	Paris		29
	Harkness and Frisby	3		Le Verrier	9
				Villarceau	6
Sum		104.5		Löwy	4
				M. C. Wolf	4
Leiden	Kaiser	51.5			
	Valentiner	11	Sum		52
Sum		62.5	Greenwich		28
				Airy	16.5
Bonn	Argelander	60		Glaisher	3.5
Milan	Schiaparelli	57	Sum		48

I.—*Tabular exhibit of the number of pages of the International Astronomical Society's Quarterly Review, &c.*—Continued.

Observatory.	Astronomer.	Number of pages.
Leipsic	Vogel	4.5
	Bruhns	11
	Engelmann	31.5
Sum		47
United States Coast Survey.		3
	Gould	40.5
Sum		43.5
Geneva	Plantamour	40.5
Rome	Secchi	38.5
Dublin	Brünnow	38.5
Bülow's private observatory.	Vogel	35
Radcliffe Observatory		13
	Main	19.5
Sum		32.5
Munich	Lamont	30.5
Stockholm	Bäcklund	11
	Gyldén	18.5
Sum		29.5
Manheim	Schonfeld	28.5
Göttingen	Copeland	28
Kiel	Peters	27.5
Münster	Heis	24.5
Capo di Monte, Naples.	Fergola	22
Hamburg	Helmert	22
Upsala	Nyrén	5
	Schultz	14.5
Sum		19.5
Harvard College		17
	Rogers	2
Sum		19
Utrecht	Höeck	3.5
	Rosén	14
Sum		17.5

Observatory.	Astronomer.	Number of pages.
Zürich	Wolf	15
Ordnance Survey Office, Southampton.	Clarke	15
Padova	Santini	14.5
Ann Arbor Observatory.	Watson	14.5
Yale College	Newton	12.5
Cape of Good Hope	Stone	11
Kiew	Chandrikow	9
Helsingfors	Krüger	9
Copenhagen	D'Arrest	5.5
	Thiele	3
Sum		8.5
Brussels		2
	Houzean	5.
Sum		7.5
Dudley Observatory		7
Wilna	Berg	6.5
Prague	Hornstein	5
New Haven	Loomis	5
Königsberg		5
Vienna	Littrow	4
Barclay's private observatory	Talmage	0.5
	Barclay	3
Sum		3.5
Altona	Peters	3
Mitan	Napiersky	3
Moscow	Schneizer	2
Cronstadt	Fuss	1.5

An inspection of the preceding table will show that, so far as astronomical work has been reviewed by this leading German Review, during the ten years of its existence, the Naval Observatory has held a large place in its voluntary notices. The acquisitions of the older observatories, accumulated for centuries, amount in their aggregate value to far more than those to which this recent institution can pretend.

II. In the report of the council of the Royal Astronomical Society of England, for the year 1874, the "Washington Catalogue of Stars," observed at the United States Naval Observatory during the year 1845 to-

1871, and prepared for publication by Professor M. Yarnall, is noted as "a valuable contribution to observing astronomy; the catalogue containing 10,658 observed stars, and including many observed in the Army and coast surveys, and many from Lacaille's Catalogue, not hitherto re-observed."

In the same report, and in the address of President Cayley, when presenting the society's gold medal for astronomical work, the contributions of Professor Newcomb to the volumes of its observation for the years 1865, 1870, and 1873, and to other publications, are commended as—

> Exhibiting, all of them, a combination, on the one hand, of mathematical skill and power, and, on the other, of good hard work devoted to the furtherance of astronomical science. The Memoir on the Lunar Theory contains the successful development of a highly original idea, and cannot but be regarded as a great step in advance in the method of the variation of the elements, and in theoretical dynamics generally; the two sets of planetary tables are works of immense labor, under the guidance of profound mathematical skill.

The announcement is also made that the tabular place of the planet Uranus, for the year 1877, had been incorporated into the British Nautical Almanac from the table calculated by Professor Newcomb. The monthly notice of the Royal Astronomical Society has also given full place to the contributions by Professor Holden on the interesting Ring Nebula in Lyra, on the Trifid Nebula, the Satellite of Uranus, and other astronomical topics.

In the most recent memoir, "L'Astronomia in Roma," from the pen of the distinguished astronomer of Rome, Padre Secchi, the observatories of "Pulkova, Greenwich, Washington," &c., are placed together in the first class.

The search for new objects has never been made a part of the regular work of the observatory, because it has generally been felt that an institution supported at the expense of the nation should confine its energies to fields known to be remunerative. Still, it has taken a place near the highest as a seat of discovery. The first discovery of a planet made on this side the Atlantic was by Mr. Ferguson, in 1854, with the old telescope of the Observatory. Recently, the discovery of two satellites of Mars, by Professor Hall, must, by the common consent of astronomers, rank as the greatest telescopic discovery since that of Neptune in 1846. Considering that Mars is the nearest planet outside the earth, and has been constantly scrutinized ever since the invention of the telescope, it will probably be conceded that this is one of the most surprising discoveries ever made. It may be remarked that the regular work of making observations, with the great telescope, on the Satellite of Saturn, in order to determine the mass of that planet, was not stopped a single night by this discovery.

It will be seen from the foregoing that the observatory is a great national institution, and that within its sphere, it amply returns, both in material value and national fame, all the sums expended upon it.

And it will also be seen that an institution which has given so much fruit should not be confined to a locality where fogs hinder the observations, and malaria undermines the energies of the observers.

Very respectfully,

JOHN RODGERS,
Rear-Admiral, Superintendent.

No. 13.—REPORT OF THE SUPERINTENDENT IN RELATION TO CHANGE OF ORGANIZATION OF THE OBSERVATORY.

UNITED STATES NAVAL OBSERVATORY,
Washington, November 26, 1877.

SIR: It has been mooted whether the observatory could not be advantageously changed in location and in organization, by putting it under a scientific head, and by creating it a national observatory under some other department of the government rather than under that of the Navy, as at present. It may surely be moved to another less objectionable site with manifest advantage. But I am supported by all the professors in my opinion that a naval organization is the most eligible one.

Practical difficulties rise up against transferring the observatory into other hands. The professors here, belonging to a fixed corps, have their positions and their compensation so secured as to conduce to their tranquil pursuit of science without the distractions of uncertain pay or of uncertain tenure of office, and without the fear of being displaced. With uncertain pay, with an ill-secured position—countermining those who undermine, as might be the case in civil service—no useful work could be done. These professors here, officers of the Navy, have been so useful at home, they have done so much to advance our international reputation as astronomers, that to cast them off would be ungracious. Yet what can be done with them? The common-sense answer is, let them alone. It is safe to say that no department of the government, other than that of the Navy, has a trained corps of observers practiced in the delicate manipulation of such large instruments. To educate others would cost time and money.

No corps in which observatory-work is casual, to be abandoned upon occasion for the proper duties of another profession, can compete with the observatories of Europe, in which astronomical observations are a life-long pursuit. The naval professors can do this, and they do successfully accomplish it. Where else under the government can their equals in this line of science be found?

If experience in any calling has actually the advantages which mankind generally attribute to it, then these gentlemen may be expected to do better work than any one not specially trained; and even further, having no special corps duties outside their present occupation, they possess qualifications superior to persons who, having a special profession outside of astronomy and mathematics, may be expected to be better versed in their specialty than in their casual employment as astronomers.

It is to be feared that a national observatory open to the whole body of American astronomers, would gravitate into the political arena, where mere unobtrusive merit would avail less than sectional partialities, or specious pleading supported by personal preference.

The Naval Observatory, arising under naval needs, has grown under its naval organization to a very high place in science. It, as well as the Observatory at Greenwich, having a source in the needs of navigation and of the Navy, is naturally under the Navy Department; and since it sprang up primarily and naturally as Greenwich did, under the Navy, so I think had it better remain there, as Greenwich does.

The changing of the character of the Superintendent from a non-scientific head to that of a professed scientist is a more difficult matter. My own prepossession before I came here was that the Superintendent should as naturally be a scientific man as that the captain of a ship should be a sailor. The duties, however, are so different that no deduction from the one case establishes a reason in the other.

The statement may, perhaps, be hazarded that authors, inventors, musicians, are naturally jealous of each others' professional reputation. It may be feared that mathematicians and astronomers are not free from the same weakness; and so far as this is true, so far would its existence militate against harmony and efficiency.

The professors, themselves, argue the question of Superintendency more forcibly than I can do, in both its aspects; the majority advocating the continuance of a line officer as head, and an able minority advocating a change in this respect by substituting a scientific head for the institution.

Taking the subject in its whole aspect, I incline to the opinion that the present organization, under which the Naval Observatory has in a short time attained so very high a place among the observatories of the world, is the most eligible one.

"Let well alone" is a safe motto, and here the present organization has done so well that we hazard nothing and keep much in following the homely advice of this proverb, "Let well alone."

Very respectfully, your obedient servant,

JOHN RODGERS,
Rear-Admiral, Superintendent.

HON. R. W. THOMPSON,
Secretary of the Navy, Washington.

UNITED STATES NAVAL OBSERVATORY,
Washington, November 24, 1877.

SIR: In reply to your request that we should express our opinion concerning the best form of organization for the United States Naval Observatory, we respectfully make the following statement:

The Naval Observatory was established in 1845, through the efforts of an officer of the Navy, the late Capt. James M. Gilliss, and although it was for a time partially diverted from its proper work, its scientific activity has been such that in the short space of thirty-two years it is conceded to have taken rank as the third observatory in the world. All this has been accomplished under the superintendency of line officers of high rank, and under only one of them have any of the interests of the institution suffered.

The superintendent of the Observatory must necessarily take charge of its financial affairs and attend to such of its interests as come before Congress and the Navy Department. These necessarily absorb nearly all his time, and no scientific man can afford to step from the ranks of scientific workers into such a position unless he hopes to build up his reputation upon the labor of others. Furthermore, there are few eminent astronomers who have not made their reputations by the cultivation of some specialty to the exclusion of almost everything else; and were such a man made superintendent of the Observatory, there would be great danger that the whole force of the establishment would be employed in advancing his specialty; thus preventing his assistants from engaging in other work of equal or perhaps greater importance, and greatly limiting the scope and usefulness of the institution.

Were the Observatory transferred to the civil service, it would lose the immense advantages which it now derives from its naval organization; and its scientific success would be endangered by the evils which are inseparable from a service subject to political influences. The expenses of the institution would also be largely augmented, because it would then have to pay for labor which is now performed by the line and staff officers of the Navy.

It may not be improper to mention that, with a single exception, the success of observatories managed by civilians in the United States has not been such as to encourage a trial of their system; and we regard it as certain that the withdrawal of naval discipline from this institution would be a serious detriment.

In view of these considerations, we are of the opinion that—

1st. The Observatory should remain attached to the Navy Department, that being the branch of the government to which it most naturally belongs.

2d. The superintendent of the Observatory should be a line officer of the Navy, of high rank, whose duty it should be to look after the business affairs of the institution, thus leaving the scientific corps leisure for their proper work.

3d. We think the plan introduced by the present superintendent, Rear-Admiral John Rodgers, of holding a monthly meeting of the officers of the Observatory, at which all the operations of the institution are discussed, is a most excellent one.

Very respectfully, your obedient servants,

M. YARNALL,
Professor of Mathematics.
ASAPH HALL,
Professor of Mathematics.
WM. HARKNESS,
Professor of Mathematics.
J. E. NOURSE,
Professor of Mathematics.
J. R. EASTMAN,
Professor of Mathematics.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent United States Observatory.

THE NAUTICAL ALMANAC OFFICE,
Washington, D. C., November 24, 1877.

SIR: In accordance with your request, I have the honor to express my opinion on the following two points:

1. Whether the Naval Observatory should remain under control of the Navy Department.

2. Whether it is more advantageous that the superintendent should be a line-officer of the Navy or a practical astronomer.

In regard to the first point, I am of opinion that it should remain under the control of the Navy Department, be the depot of the naval chronometers, and have the same relation to the Navy Department that the Greenwich Observatory bears to the admiralty of England.

In regard to the second point, I am of opinion that the establishment should have a scientific head, for these reasons:

1. The generally-recognized necessity that every office should, so far as practicable, be under a head professionally acquainted with its routine of business, exists here. The most important duty of the superintendent is to see that the observations made and the work performed are those most advantageous for the objects with which the institution

was founded; that the calculations are correctly made; and that harmonious co-operation is secured among the various departments. The securing of these objects requires a permanent policy, which can only be inaugurated by a scientific head. As illustrative of this view, I may cite the fact that during one-fourth the existence of the Naval Observatory the publication of the annual volumes of observations was entirely omitted, for the reason that only one or two observers made any observations worth publishing. The most important want of national astronomy at the present time is general tables of the stars and planets corresponding to the present state of practical astronomy; and it is a want which can, in its full extent, be supplied only by a large and well-organized observatory, securing the co-operation of many minds in the work of observation and calculation. I am unable to see how such a work as this can be successfully executed, except under constant scientific supervision of the establishment.

2. It seems to me that a new observatory should be built and administered with some one or more well-defined objects in view, and that these objects should be those of the fulfillment of which science stands most in need. Scientific control in some form would, I think, at least tend to assure the public that this end was being secured, though it might be executed by a commission or a board as well as by a single person.

3. I think that individual astronomers of talent are more secure in the recognition of their scientific claims under a head professionally interested in the advancement of science. It is a part of the law of scientific publication—unwritten, indeed, but universally recognized in the scientific world—that every man doing original work should be recognized in its publication as the author of it. But, during more than half of the existence of the Naval Observatory, this right was not recognized, the name of the author being either entirely suppressed, or only mentioned in some other place than the title-page of the work. That this is not now the case is due solely to the liberality of yourself and of your immediate predecessors.

Very respectfully, your obedient servant,

SIMON NEWCOMB,
Professor, United States Navy.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent of the Naval Observatory, Washington.

OBSERVATORY, *Washington, November* 24, 1877.

ADMIRAL: Referring to the questions upon which you desire the opinions of the professors at the Observatory, I have to say:

1st. That, in my opinion, it would be highly detrimental to the interests of the Observatory, and to a less but still an important degree to those of the Navy, should the connection between them be severed.

2d. On the second point, I am of the opinion that the scientific head of the Observatory should be a professional astronomer. It does not seem essential that he should be the executive head, although this is the case at Greenwich, Paris, &c. At Greenwich, the Royal Observatory is under the admiralty, by whom a civilian (Astronomer Royal) is designated to direct the astronomical work of the institution.

The observatory is yearly inspected by a board of visitors, reporting to the admiralty, and, from 1836, the date of appointment of the first board of visitors, until 1877, no change in this respect has been found desirable. The Astronomer Royal of England has, since 1675, over two hundred years been appointed in this manner from the distinguished professional astronomers of England, and has been directly responsible to the lords of the admiralty, and the system has worked well for two centuries. Although the United States Naval Observatory has attained great usefulness under the present system, there was a period of twelve years, in its short life of thirty-two years (over one-third), when its energies and its appropriations were diverted from its proper field, astronomy, and devoted to another subject, no less important, indeed, but a subject not intended to absorb all its energies. During this time, two professors of the Navy, in spite of many obstacles, by their efforts saved it from total inaction in its own field. This is not likely to occur again; but under a professional astronomer it could not occur.

I therefore respectfully submit that, in my opinion, the best interests of the Navy and of the Observatory would be forwarded by making a professional astronomer the scientific head of the observatory, and by retaining the Observatory directly under the Navy Department. While this is, in my opinion, best, the present efficiency of the institution shows that no change is imperative.

Very respectfully, your obedient servant,

EDWARD S. HOLDEN,
Professor.

Rear-Admiral JOHN RODGERS, U. S. N.,
Superintendent United States Naval Observatory.

No. 14.—REPORT ON FRESH-WATER BASIN NEAR NORFOLK.

UNITED STATES NAVY-YARD, LEAGUE ISLAND, PA.,
September 22, 1877.

SIR: The board of civil engineers, constituted by order of the Navy Department, dated 5th September, 1877, to locate and prepare plans and estimates of cost of a fresh-water basin for iron vessels, in the immediate vicinity of the Norfolk navy-yard, has the honor to submit the following report:

The board convened at Norfolk on the 12th of September, and entered immediately upon its duties. Having finished the necessary examinations in the vicinity of Norfolk, the board adjourned to League Island navy-yard, where it reassembled on the 19th and continued in daily session until the 22d, on which day it was dissolved, its duties having been completed.

Norfolk navy-yard is situated about one and a quarter mile above the city of Norfolk, on the southern branch of the Elizabeth River, a short, tidal, salt-water stream of considerable width, having several small fresh-water affluents. The maps accompanying this report show the topography and hydrography of the section of country examined in relation to the subject before the board. The general features of the land in the vicinity of the river and its branches, as far up as the village of Deep Creek, are a nearly level surface from four to ten feet above ordinary high tide, a sandy soil from ten to twelve feet deep resting upon an irregular stratum of gravel and clay, generally several feet in depth, with an underlying substratum of hard, impervious clay at a depth of from fifteen to twenty-five feet below high water. Bordering the creeks and bayous are considerable areas of marsh-land at high-water level.

The Elizabeth River, in front of the navy-yard, has a width of about six hundred and fifty feet from the navy-yard quay-wall to the harbor commissioners' line on the opposite side of the river. Above, the width of the deep-water channel decreases and becomes quite irregular, although the shoal-water enlarges to a width of half a mile. There is a depth of water of about thirty feet at mean low tide in front of the navy-yard, but above the yard the depth decreases to about twenty feet. In approaching the general question of the location and construction of a fresh-water basin, three principal subjects were presented for consideration:

1. The most convenient and useful location for the basin in its relations to the navy-yard, and the general requirements of the Navy, having due regard to economy in the purchase of the necessary site.
2. The best and most economical plan of fresh-water supply.
3. The most economical mode of construction consistent with usefulness and durability.

I.

The instructions to the board were, that the location of the basin should be "in immediate connection with the navy-yard," and the interests of the service alike seemed to demand that the basin should be established at a point easily accessible from the yard by both land and water. The land on the banks of the river below the navy-yard being occupied with buildings, wharves, and other improvements, especially on the navy-yard side of the stream, was deemed too valuable to be applied to the purpose contemplated. Above the navy-yard, within a practical distance on either shore and including the shore opposite the yard, are several localities that were carefully examined and considered by the board in regard to their adaptability as sites for the proposed basin.

Opposite the lower end of the navy-yard is a point of land known as St. Helena, embracing about twenty-six acres belonging to the government, and occupied in connection with the yard, for ordnance purposes. Above and adjoining this point is a tract of land known as Cedar Grove, inclosing a small shallow creek or bayou, which has been proposed by the owners of the property as a suitable place for a basin. A similar tract, but having a larger creek, situated a short distance above on the same side of the river, was also suggested as a desirable location. The board having carefully weighed the reasons in favor of these sites, was led to reject them on account of the higher price of the land and improvements, the extra cost of excavating the basin by reason of the considerable elevation of a portion of the land, the increased cost of water-supply as hereafter explained, and mainly on account of the importance of having the basin within easy communication with the navy-yard by land as well as by water. On the western, or navy-yard side of the stream, two locations were examined, one at Back Creek and one at Paradise Creek. The water basin in each of these localities is larger than those on the opposite side of the stream and the construction of a basin would involve less dredging. Paradise Creek possesses the slight advantage over the lower site of having a narrower entrance between the points of the high land, and a larger and deeper body of water, so that the excavation of a basin could be made at less cost. It has also the advantage of being about a mile nearer the source of water-supply than the lower location. An objection to this site lies in the fact that the creek is used for the purposes of water-communication by persons owning the property on the upper part of the creek. The main objection, however, and one that in the opinion of the board is sufficient to cause the rejection of this site, is its great distance from the navy-yard, rendering land-communication costly and impracticable.

The only remaining location considered worthy of examination was a tract of land embracing Back Creek and lying adjacent to the upper end of the navy-yard. The basin, if located on this tract, would be almost entirely within the low-water line and therefore easily excavated. A considerable part of the land around the basin would be nearly at the height of the established grade of the navy-yard, and the remainder could be easily filled to that height. The land between the basin and the navy-yard, needed in part for the purpose of communication, also requires but a moderate amount of filling, easily made with the material excavated from the basin. The whole tract of land intervening between the basin-tract and the navy-yard would be very valuable and in fact almost indispensable for the future extension of the yard, and could be placed at the proper grade with a very moderate expenditure. The cost of the land would doubtless be more than at Paradise Creek, and the expense of obtaining fresh water would also be greater; but, taking all things into consideration, a fresh-water basin could be constructed on this tract with a smaller expenditure than at any other point. In the opinion of the board the comparatively unimportant objections to this location are far more than counterbalanced by the reasons in its favor above mentioned, and especially by the very important and even paramount advantage that would be gained by the selection of this tract on account of its being within a practicable distance from the navy-yard. In view of these facts, and other minor reasons carefully considered, the board has unanimously arrived at the conclusion that the Back Creek tract, as shown by the accompanying plans, best combines all the requirements for providing in the most convenient, feasible, and economical manner a fresh-water basin of large dimensions, in immediate connection with the yard. The board therefore has selected this site as best adapted to the purpose.

II.

The second general division of the subject, the supply of fresh water for the basin, received the careful consideration of the board, the more especially on account of the intrinsic difficulties and the importance of the problem. This question resolved itself into several sections, each of which was duly investigated:

1. The source of supply.
2. The quality of the water obtainable.
3. The quantity and permanence of supply.
4. Cost.
5. Method of construction of works.

I.—The sources from which a supply of fresh water might be obtained in this vicinity have been examined at different times during the last half century, by various persons in the interests of the United States and the cities of Norfolk and Portsmouth. The results of these examinations show six sources from which it is more or less practicable to obtain a supply of water:

1. West Neck River, in Princess Anne County.
2. Moore's Bridge and the small lakes in that locality, in the same county.

3. The East and West branches of the Nansemond River, near Suffolk.
4. Deep Creek.
5. Lake Drummond, in Dismal Swamp.
6. The Dismal Swamp Canal.

II.—The quality of the water in the West Neck River is inferior, being at times brackish from the influx of salt water from Currituck Sound, as stated by Mr. W. J. McAlpine in his report on the Norfolk water-supply. The water obtainable from the second source is of good quality, but deeply colored with vegetable matter. The Nansemond water is of excellent quality, and but slightly tinged with color. The waters from the last three sources mentioned are similar in quality, that of Lake Drummond being the purest and least discolored. The Dismal Swamp Canal is fed from Lake Drummond and Dismal Swamp, and a considerable overflow enters Deep Creek, except during the dry summer months. The Lake Drummond and canal waters are stained a wine color by the vegetable matter of the Dismal Swamp, mainly by the juniper or white cedar. This has been supposed by some to contain tannin and vegetable acids sufficient to corrode iron. If such were the case, it would, of course, preclude the use of this water for floating iron vessels; but the observed facts do not sustain that theory. A few years ago the lock-gates of the canal-feeder from Lake Drummond were removed after having been immersed in the water twenty-three years, and the iron-work was found nearly free from oxidization. Similar conditions have been noticed in other cases, and the board observed iron-work that had been exposed to this water for many years without injury. Chemical tests of the water confirm the results of these practical observations.

III.—The quantity of water required for the purposes of a fresh-water basin is of course somewhat problematical, owing mainly to the uncertainty as to the size and number of vessels that the future need of the service may require to pass through the tidal lock. After due consideration the board fixed the size of the proposed basin at twenty acres, and estimated the probable future maximum lockage per month at fifteen vessels of two thousand tons each. This attempt at an exact determination of a matter so far in the future, and possessing such variable and indeterminate conditions, is made only because the estimate of the water-supply renders such a basis of calculation necessary. An allowance of 50 per cent. on the tonnage of each vessel is made for waste in lockage. The amount of evaporation in an open basin in the latitude of Norfolk, 36° 50′, and so near the sea, may be safely taken at an average of two-tenths of an inch per day during the hot summer months, with a maximum of three-tenths during short periods. As there is no month without some rain-fall, the compensation from that source and from dew will reduce the net average evaporation, in a summer month of minimum humidity, to about fifteen hundredths of an inch per day. The percolation from the proposed basin, constructed as designed, will be very slight, as the head of water will never exceed six feet at ebb tide, and will generally be but three feet at such time and only a few inches at high tide. The ground surrounding the basin will be mostly mud and clay, saturated with water at each tide, and consequently almost impervious to the water in the basin. The allowance for percolation is therefore small. The leakage from the lock and dam involves a small loss, which has also been taken into consideration. The water required under these assumed conditions has been calculated at a maximum of seventy-five thousand cubic feet per day. For some years to come a smaller quantity would doubtless suffice.

Of the six sources of supply named, the first three and the fifth would furnish a much larger quantity than would be needed. The supply from

Deep Creek would probably not be reliable in periods of extreme drought unless increased by a feeder from Lake Drummond or the canal. The quantity of water that could be drawn from the Dismal Swamp Canal without interfering with its navigation would be sufficient, except during a portion of the summer months. During extreme drought in those months, especially should the navigation of the canal increase very considerably and its condition remain as now, there would be a considerable deficiency. This could be obviated by deepening the feeder from Lake Drummond to the canal, as the capacity of the lake is great enough to furnish a sufficient and permanent supply. It is the understanding of the board that neither the Dismal Swamp Canal Company nor any other parties have exclusive control of the waters of Lake Drummond, the State of Virginia still retaining its right to grant to others the privilege of using a portion of the water. This right it has recently exercised in an act chartering the Portsmouth Water Company.

IV.—The cost of the works necessary for obtaining a supply of water from several of the sources mentioned would be so great as to exclude them from the number available for the purposes in view. This excessive cost would be caused in part by the long lines of pipe to be laid, and in part by the necessity of pumping the water to obtain the proper head. These objections apply to the first, second, and third sources of supply, which were therefore excluded from further consideration by the board. The necessity of pumping, to obtain a head of water from Deep Creek, taken in connection with the probable deficiency in the quantity of water from that source during periods of drought, led the board also to reject that plan. The fifth or Lake Drummond source of supply would involve a very expensive construction should a pipe line be built from the lake, a distance of nearly twenty miles. An open canal could be built from the lake to the northern end of the swamp, to connect with a pipe line from thence to the basin. Such a canal would be cheaper than an iron pipe, but the advantages gained by the construction of a canal could be obtained in a much cheaper manner by deepening the feeder from the lake to the Dismal Swamp Canal and laying a pipe from the canal at Deep Creek to the basin. As the United States has a two-fifths interest in the canal, it is probable that the deepening of the feeder could be arranged without difficulty. The cost of the deepening would be from seven thousand to ten thousand dollars. The adoption of this plan would be identical with that mentioned as the sixth, or Dismal Swamp Canal source of supply. The cost of this sixth plan would be much less than any of the others, while it would also possess all the essential advantages of the other plans. The cost of construction, therefore, determined the source of supply and the board decided in favor of the line from the Dismal Swamp Canal.

V.—The method of construction recommended is, to carry a line of fifteen-inch pipe from the canal above the locks at Deep Creek in a nearly straight line to the basin. At the lowest stage of water in the canal and the highest proposed level in the basin there would be a head, or fall of water in the pipe, of eight feet. With a fifteen-inch pipe and that head the delivery would be 96,000 cubic feet of water per day, which would furnish the 75,000 cubic feet estimated as required and leave a liberal allowance for leakage and other waste. In case the supply of water from the canal shall be found insufficient for the basin, an additional and abundant supply could be obtained by deepening the feeder from Lake Drummond, as already mentioned. Accompanying this report is a profile of the proposed line of water-supply, prepared chiefly from a survey made for the Navy Department by Colonel Baldwin, civil engineer, in the year 1828.

III.

The third general division of the subject before the board, the most economical mode of construction consistent with usefulness and durability, was examined as carefully and as much in minutiæ as practicable.

1. The best method of constructing the works necesary for the water-supply has already been mentioned under that head. Pipes of wood, cement, and sheet-iron, and other materials, have been proposed and used for various water-works; but the best practice of engineers has decided that, for durability, efficiency, and ultimate economy, cast-iron water-pipes are the best. The board, therefore recommends that material for the proposed pipe line from the canal at Deep Creek to the basin. Should it become necessary to increase the water-supply by deepening the feeder from Lake Drummond to the Dismal Swamp Canal, as before mentioned, the work can be best accomplished by dredging and throwing out the material on either side, work that can be done at a very limited cost, so that the expense of dredging out the feeder its entire length of three and a half miles would not exceed ten thousand dollars as stated.

2. The construction of the basin in an economical manner, and yet with due regard for the durability that should appertain to government works of this character, was a subject involving many important questions that were carefully considered by the board. The discussion of the plans suggested for the various works would be too long to enter in this report. The board therefore confines itself mainly to a statement of its conclusions and a general description of the works recommended for the object in view.

After the selection of the Back Creek tract as a site for the proposed basin, its exact location at a distance of 1,000 feet from the upper end of the navy-yard was made for two reasons: First, to lessen the amount of excavation as much as possible; second, to reserve ground and water-front for future addition to the navy-yard, should its extension become necessary. It was deemed inexpedient for several reasons, mainly those of economy, to locate the basin so far to the front as the probable quay-wall line of the navy-yard extension, and therefore the position of the basin was fixed, as represented on the plans, at a distance of 350 feet from the proposed quay-wall line. The size of the proposed basin has been fixed at 900 feet by 968 feet, making 20 acres, including that part of the entrance lock within the rectangle of the basin. The entrance or tidal lock, as shown by the plans, has a length of 400 feet between the gates with a width of 80 feet at the water-line, and has two flooding-gates, the inner one of which can be placed at three different points, so as to make a lock-chamber of 200, 300, or 400 feet in length, as desired. To economize in construction, three-fourths of the lock is placed within the basin. Should the navy-yard hereafter be extended, and the quay-wall built on the line now projected, the lock-chamber can be lengthened, if desired, or an entrance-slip carried out to the quay-wall. It is proposed that the basin be excavated by dredging and the material mainly disposed of in filling up the low ground of the area to be acquired. The height of the water in the basin is designed to be kept usually at or a little above ordinary high tide, and as the water in the basin, and generally that in the lock, will be fresh timber-work can be used in the construction of the walls without fear of injury from the *teredo navalis*. Advantage has been taken of that fact to design a cheap but efficient and durable form of retaining or basin wall, as shown by the plans submitted with this report. The work above low-water line is proposed to be of stone, in order to insure the durability of the structure. The walls of the tidal lock are proposed to be of timber crib-work surmounted with stone, as shown by the plans. The outer ends of the walls, however, for a distance of 40 feet, will consist of heavy stone abutments rising from a depth of 30 feet below low water and grooved to receive the floating gate. The abutment-wings, each 200 feet long, will be formed of timber crib-work surmounted with a stone wall. That portion of the wood-work of this crib that will project above the mud slope and be exposed to the salt water it is proposed to protect from the teredo by a facing of stone about 2½ feet thick, clamped to the timber and supported by projecting offsets in the crib. The bottom of the crib will project in front sufficiently to give a firm base. By this plan an economical structure can be formed that will be durable in salt water and resist the encroachments of the teredo. The sill of the outer gate is to be formed by a timber floor, 40 by 80 feet, supported by two rows of 12-inch sheet-piling and six rows of round piles, the outer face of the entrance and 40 feet on either side being protected by an additional row of 12-inch sheet-piling. Further protection to the outer sill, the abutments and the wing-walls, will be afforded by riprap, as may be found necessary. The sill for the inner floating gate in its three positions will be formed in a similar but less expensive manner. No floor is deemed necessary for the outer portions of the lock-chamber.

3. The estimated cost of the fresh-water basin and the works appertaining to it is as follows:

Land.		
To be purchased, 81.5 acres, @ $150		$12,225 00
Basin.		
992,000 cubic yards dredging, @ 10 cents	$99,200 00	
3,936 linear feet basin-wall, of masonry, with pile foundations, @ $35	137,760 00	
840 linear feet lock-chamber wall, of masonry and crib-work, @ $40	33,600 00	
2 abutment-wings, cribs, with masonry face and wall	33,113 00	
2 masonry abutments	51,200 00	
2 gates of iron, and appliances	35,000 00	
1 outer-gate floor, sill, and apron	31,550 00	
3 inner-gate sills, &c	20,522 00	
Total for basin proper		441,945 00
Water-supply.		
27,264 linear feet of 15-inch cast-iron pipe, laid, including valves and other appurtenances, @ $2.84	$77,430 00	
Cost of deepening feeder of canal if found necessary	10,000 00	
Total for water-supply		87,430 00
Aggregate estimated cost		541,600 00

The quantity of land deemed desirable to purchase, including all above the low-water mark within the boundary-lines, as shown by the accompanying plans, is 81.5 acres. The cost of this land, it is thought, should not exceed $150 per acre, including the water-front. Should the navy-yard be extend to the proposed quay-wall line, the whole territory added to the yard, including the 81.5 acres purchased, would be 157.8 acres.

From the foregoing estimates it will be seen that the relative cost of the more important parts of this work is as follows:

	Per cent.
Land	2.25
Basin	81.60
Water-supply	16.15

In regard to the basin proper, it may be remarked that a cheaper or make-shift plan of construction might have been adopted by simply providing for dredging out the basin and making no wall excepting on the water-front; but such a basin would be very inconvenient and expensive in use, and the source of constant expense in dredging to keep the proper depth of water, and is not considered by the board as either desirable or practicable. The front wall or dam and the entrance lock are designed upon plans as economical as possible, consistent with durability, in such an exposed situation.

We have the honor to be, very respectfully, your obedient servants,

FRANKLIN A. STRATTON,
Civil Engineer, U. S. N.
A. G. MENOCAL,
Civil Engineer, U. S. N.
U. S. G. WHITE,
Civil Engineer, U. S. N.

Rear-Admiral JOHN C. HOWELL, U. S. N.,
Acting Secretary of the Navy.

No. 15.—STATEMENTS OF INDEBTEDNESS.

Statement showing the indebtedness of, and the amounts due, the Bureau of Provisions and Clothing, June 30, 1877.

	Provisions.	Clothing.	Pay.	Contingent.	Total.
Amount of bills unpaid	$55, 846 31	$385, 189 08	$28, 500 00	....	....
Due the various bureaus	37 07	....	....	....	....
Due "Pay of the Navy" on account of purchases and expenses of storehouses abroad	225, 742 77	3, 459 05	....	$4, 548 30	....
Due hospital fund	4, 909 89	....	....	....	....
To pay freight on foreign stations	....	....	....	3, 935 91	....
	286, 536 04	388, 678 13	28, 500 00	8, 484 21	$712, 198 38
Amounts due Bureau of Provisions and Clothing from other bureaus	3, 887 65	1, 114 71	....	2, 077 70	....
Amount due "Clothing" on account of clothing issued and checked against appropriation "Pay of the Navy"	....	339, 200 23	....	....	....
Due the bureau from the Marine Corps	1, 699 74	....	....	....	....
	5, 587 39	340, 314 94	....	2, 077 70	347, 980 03
July 1, 1877, balance, indebtedness of bureau	280, 948 65	48, 363 19	28, 500 00	6, 406 51	364, 218 35

Statement of indebtedness, Bureau of Construction and Repair.

See page 280, amount there stated	$1, 426, 228 13
Harlan & Hollingsworth Co., 1876, on account of Ranger and Pilgrim	2, 248 10
S. P. Brown, 1877, timber	7, 680 00
Total	1, 436, 156 23

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